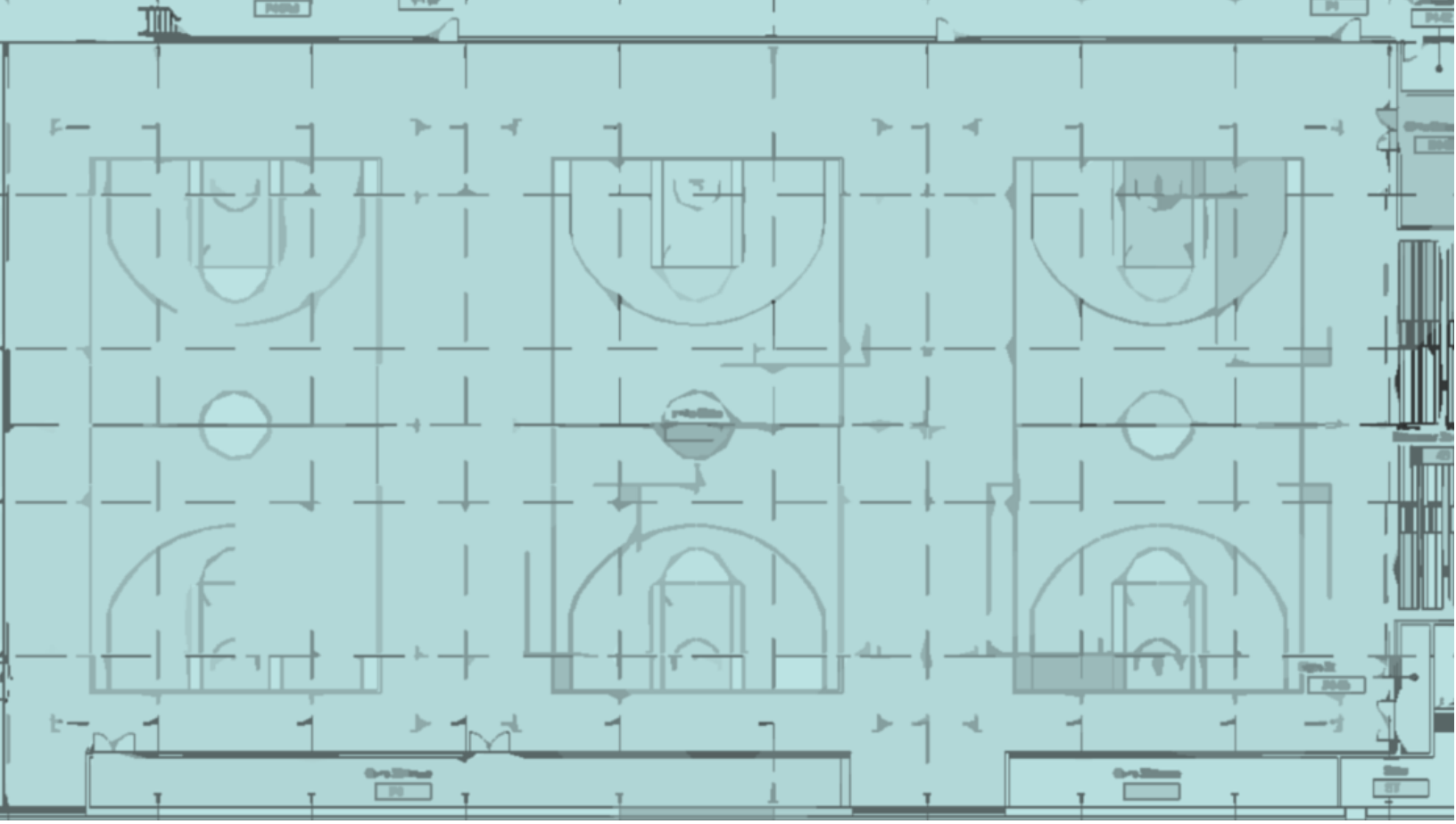

Final Report

South Winnipeg Recreation Campus Traffic and Parking Study

City of Winnipeg

MMM TRANSPORTATION CONSULTING

Final Report

South Winnipeg Recreation Campus
Traffic and Parking Study

Prepared by

MORR Transportation Consulting Ltd.

Winnipeg, Manitoba

Submitted to

City of Winnipeg

Winnipeg, Manitoba

March 2025

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Report Prepared by:

Steven Florko, P.Eng.

Report Reviewed by:

Stephen Chapman, P.Eng. RSP

ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
MORR Transportation Consulting Ltd.
No. 5694

PROVINCE OF MANITOBA
S. N. CHAPMAN
Member
21941
REGISTERED PROFESSIONAL ENGINEER
March 20, 2025

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1 INTRODUCTION

The South Winnipeg Recreation Campus (SWRC) is expected to become a multi-use, multi-generational, regional recreation campus in the Waverley West neighbourhood of Winnipeg. As part of the planning and design process, MORR Transportation Consulting Ltd. (MORR) was retained as a subconsultant to complete this Traffic and Parking Study for SWRC with a focus on Phase 1 of the campus development. The study is intended to support the project's approval process by providing a documented analysis of the traffic and parking components of the project.

The SWRC site is currently vacant. Phase 1 development of the SWRC site is proposed to include a new recreation building (over 8,000 m^2) which will contain three gymnasiums, multi-purpose rooms, an indoor walking track, and fitness spaces with an attached 1,800 m^2 childcare facility. A new fire station is also proposed for a portion of the site in Phase 1 along with internal roads, parking areas, and a splash pad. Future phases of the campus may include a library, an aquatics centre, and twin ice rinks along with outdoor playing fields and other outdoor amenities.

The purposes of the Traffic and Parking Study were to:

- Review how SWRC will connect to and impact the nearby transportation system.
- Identify treatments to mitigate any unacceptable impacts.
- Estimate the parking and loading demand for the SWRC site.

The scope of the study included:

- Traffic Operations Analysis to identify appropriate provisions for vehicle traffic at the study intersections.
- An Active Transportation Review to identify connections to the external active transportation (AT) network.
- A Site Plan Review to identify potential improvements to pedestrian, cyclist, and vehicle circulation within the site, and to evaluate the proposed parking and loading supply against By-law requirements and estimated demand.

The study area encompasses the SWRC site and sections of Bison Drive, Ruth Crossing, and Joe Keeper Way.

1.1 Report Organization

The report is organized into the following sections:

- Study Context outlines characteristics of the SWRC site and the surrounding area that are relevant to the study.
- Traffic Volumes presents traffic volumes for existing conditions, forecasts of future background traffic growth from development of Waverley West B, and total post development traffic volumes.
- Transportation Analysis details the assumptions, processes, results, and findings for the analyses of traffic, pedestrians, parking, loading, and circulation.
- Conclusions and Recommendations presents the findings from the study, and the study team's recommendations.

2 STUDY CONTEXT

The SWRC site is located south of Bison Drive, east of Ruth Crossing, and north of Joe Keeper Way in the Waverley West neighbourhood of Winnipeg, Manitoba. The SWRC is in the last area of development of Waverley West, commonly referred to a Waverley West-B. Waverley West-B development is ongoing and there is already an elementary school (Bison Run School) and high school (Pembina Trails Collegiate) in operation since September 2023, immediately to the east of the SWRC site. There is an expectation that the SWRC site and the school site will have an integrated design. The SWRC site itself is currently vacant undeveloped land. Land to the north is the developed Bridgwater Forest neighbourhood. Lands to the west, and south are residential areas in various phases of development.

Figure 1 shows the location of the SWRC site in context.

FIGURE 1: LOCAL CONTEXT

2.1 Development Parameters

The proposed plan for SWRC includes a variety of uses. These components have different traffic characteristics in terms of types of users and time of day and day of week of peak use. In addition, there is an intent with the site plan to promote the use of sustainable modes of travel.

Phase 1 of SWRC development is proposed to include the following land uses:

- A 90,000 ft^2 recreation centre containing three gymnasiums, multi-purpose rooms, an indoor walking track, and fitness space, in a two-storey building.
- A 20,000 ft^2 childcare facility accommodating 48 infants, 128 preschool kids, and 53 staff.
- An outdoor spray pad
- A fire station

Future phases of SWRC development may include the following land uses:

- Library (14,500 ft^2)
- Aquatics Centre (30,000 ft^2)
- Two indoor hockey rinks (83,000 ft^2)
- Outdoor amenities such as outdoor basketball court, tennis court, pickleball courts, a skate/BMX area, and four soccer fields

Vehicular access to SWRC, excluding the fire station, is to be provided by an all-directional access at the intersection of Ruth Crossing and Rangeview Way, and all-directional approach on Joe Keeper Way, and a right-in/right-out approach for service vehicles on Bison Drive. The fire station is planned to have independent access to Ruth Crossing. The SWRC site is to include connections to sidewalks and paths on Bison Drive, Ruth Crossing, and Joe Keeper Way.

Figure 2 illustrates the SWRC Phase 1 schematic site plan. For the purposes of the study, Phase 1 development was assumed to be complete and ready for fall 2027.

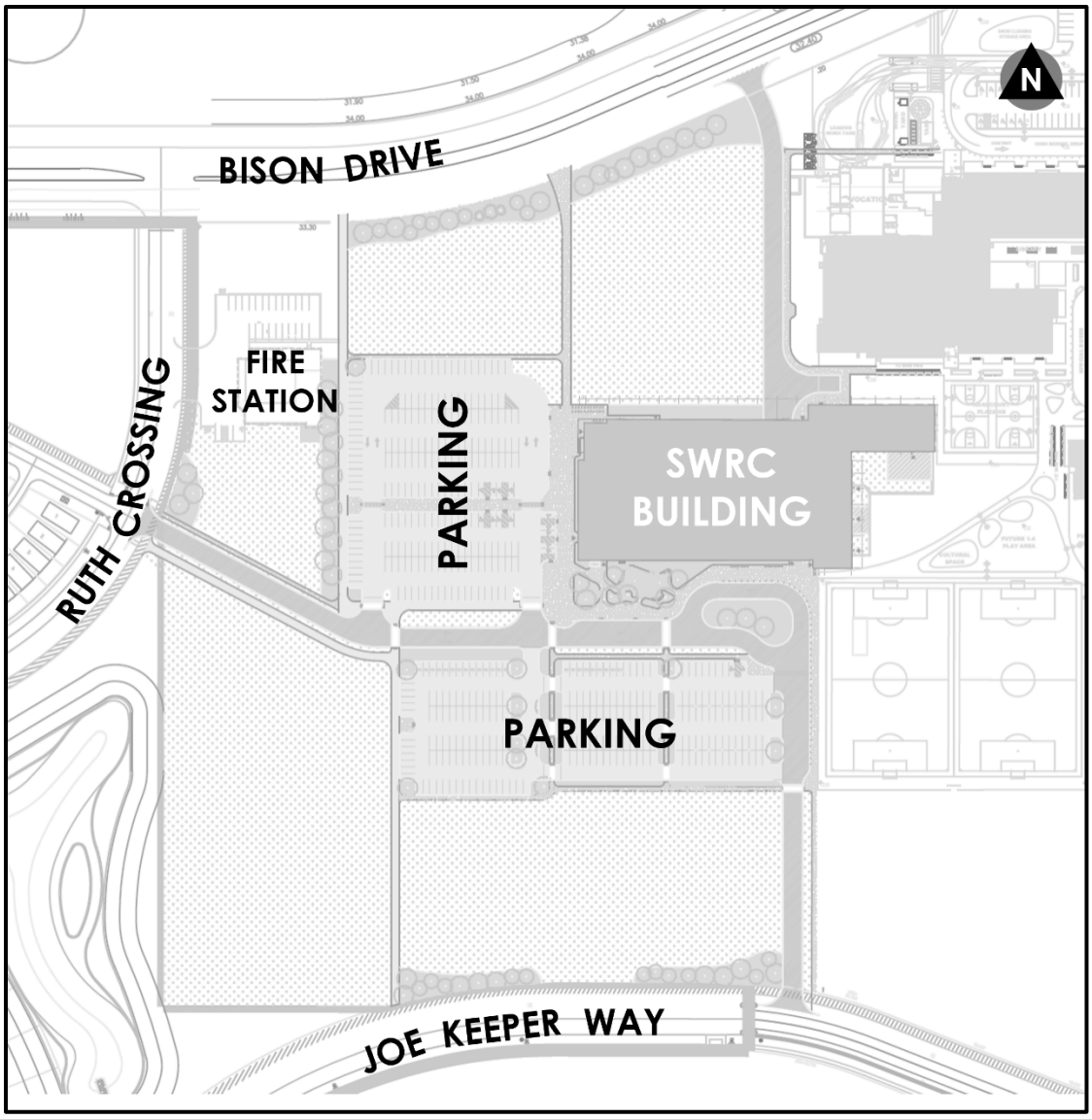


FIGURE 2: SWRC SCHEMATIC SITE PLAN

2.2 Study Area

The study area encompasses the SWRC site and its accesses plus the Bison Drive intersections at Ruth Crossing and Frontier Trail. Four study intersection were included for detailed analysis:

1. Bison Drive at Ruth Crossing
2. Bison Drive at Frontier Trail/North Town Road
3. Ruth Crossing at the SWRC access, across from Rangeview Way
4. Joe Keeper Way at the SWRC access

Figure 3 shows the study area.

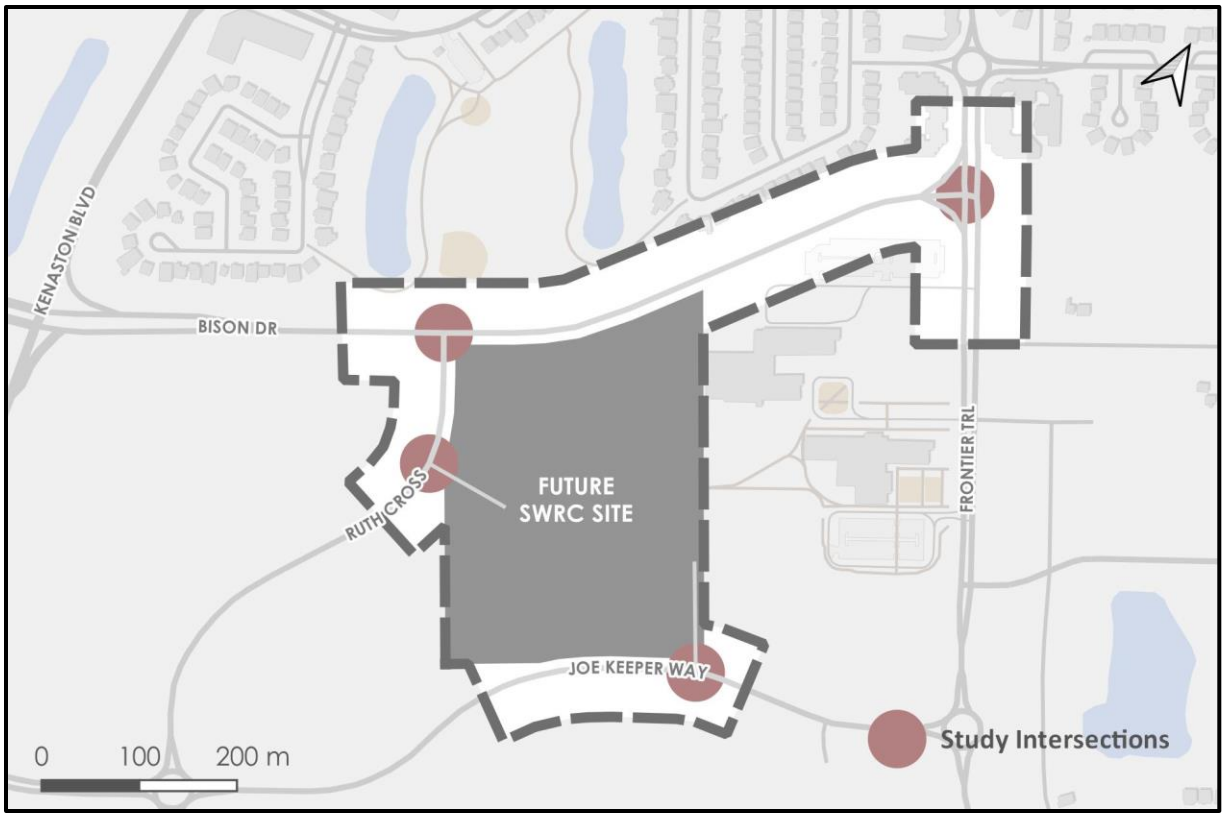


FIGURE 3: STUDY AREA

Note that the service access to Bison Drive and the fire station accesses were not included as study intersections, as those accesses are not for public use, and they were expected to see lower levels of activity.

2.3 Transportation Infrastructure

Table 1 shows the existing characteristics of the main streets in the study area.

TABLE 1: STREET CHARACTERISTICS

Street	Functional Classification	Speed Limit	Basic Cross Section
Bison Drive	Arterial	50 km/h	Two lane undivided
Ruth Crossing	Collector	50 km/h	Two lane undivided
Joe Keeper Way	Collector	50 km/h	Two lane undivided

Bison Drive is a partially constructed east-west arterial street in the study area. Currently, Bison Drive connects Appleford Gate at its west limit to Frontier Trail/North Town Road at its east limit with major signalized intersections at Kenaston Boulevard Northbound and Kenaston Boulevard Southbound. Along the SWRC frontage, Bison Drive is a two-lane undivided road with a 50 km/h speed limit. In the future (perhaps 5 to 10 years from now), Bison Drive is expected to extend east to the other section of Bison Drive at Waverley Street which will connect it further east to Pembina Highway and the University of Manitoba. With the connection to Waverley Street, Bison Drive at SWRC is expected to be widened to a four-lane

divided cross section with the speed limit potentially increasing to 60 km/h. With future extension to the east, Bison Drive is expected to provide a significant mobility function as a connection between residential, commercial, and institutional land uses in southwest Winnipeg.

Note that this TIS did not consider a scenario where Bison Drive is extended from Frontier Trail to Waverley Street, or a scenario where Bison Drive is widened beyond the existing two-lane undivided cross-section. In this TIS, Bison Drive was only considered in its existing configuration as of March 2024.

Ruth Crossing and Joe Keeper Way are undivided collector streets in the Bison Run neighbourhood. At the time of this study, roadway construction is nearing completion and development of residential properties on both streets are underway. Consideration of Ruth Crossing and Joe Keeper Way is this study is largely based on full-build out traffic projections for the neighbourhood.

2.3.1 Active Transportation Infrastructure

The site is well connected to existing and planned active transportation infrastructure in the study area, including:

- An existing multi-use path on the south side of Bison Drive.
- A planned wide multi-use concrete sidewalk on the east side of Ruth Crossing (a standard sidewalk is planned on the west side).
- A planned wide multi-use concrete sidewalk on the north side of Joe Keeper Way (a standard sidewalk is planned on the south side).

There are also park pathways in the green space on the north side of Bison Drive. Section 4.2 includes discussion on connections between the SWRC paths and those paths.

2.3.2 Transit Service

Transit service is anticipated on Bison Drive as part of the City's June 2025 Primary Network implementation. The proposed route (Route 74) is a connector route with 15–30-minute peak and off-peak service connecting the University of Manitoba, Polo Park, and northwest Winnipeg. Bus stops are anticipated on Bison Drive close to SWRC; however, a final location had not been determined for the stops at the time of this study.

2.4 Analysis Scenarios

Analysis scenarios were selected based on the assumed Phase 1 opening year in 2027 and the 2041 traffic projections for full build out of Waverley West B. The resulting scenarios were:

- 2024 Existing Conditions
- 2027 Background Conditions
- 2041 Background Conditions
- 2027 Phase 1 Post Development Conditions

- 2041 Phase 2 Post-Development Conditions

The 2041 Post Development scenario was considered at a high level based on future phases of SWRC, as a sensitivity check on Phase 1 results.

In each scenario, traffic volume estimates were prepared for the weekday AM and PM peak hours, and for weekday daily traffic. The peak hours were intended to coincide with the peak hours of background traffic on Bison Drive, as the total post-development traffic volume at those times was assumed to be greater than the total traffic volume when SWRC is at maximum trip generation—likely later in the evening on weekdays or mid-day on weekends.

3 TRAFFIC VOLUMES

Traffic volumes were quantified in terms of existing traffic, future background traffic growth, development generated traffic, and post-development traffic. The following sections outline the processes and assumptions used to calculate those traffic volumes.

3.1 Existing Traffic Volumes

Traffic volumes for 2024 existing conditions were quantified through a new intersection turning movement count (TMC) completed by MORR at the following location:

- Bison Drive at Frontier Trail/North Town Road
  Date: Wednesday, March 13, 2024
  Times: 07:00 – 19:00
  Weekday AM Peak Hour: 07:45 – 08:45
  Weekday PM Peak Hour: 15:00 – 16:00

Counted traffic volumes were adjusted to the nearest five vehicles per hour (vph) to avoid showing more precision than was appropriate for volumes collected on a single day. When the counts were conducted there was construction of homes along Ruth Crossing, but no homes were occupied, as far as MORR could discern. As such, counts were not conducted at the intersection of Bison Drive and Ruth Crossing, and existing volumes at the intersection were only considered in terms of through traffic on Bison Drive.

Figure 4 shows the volumes after the rounding adjustment. Those volumes represented the 2024 Existing Conditions scenario. Daily volumes were estimated at 1.33 times the 12 hour counted volumes, consistent with typical City of Winnipeg practice. Daily volumes were rounded to the nearest 100 vehicles per day (vpd). The resulting daily volumes were 6.5 to 6.7 times the average of the peak hour volumes—somewhat lower than typical, but likely reflecting the lack of development in the area aside from the schools.

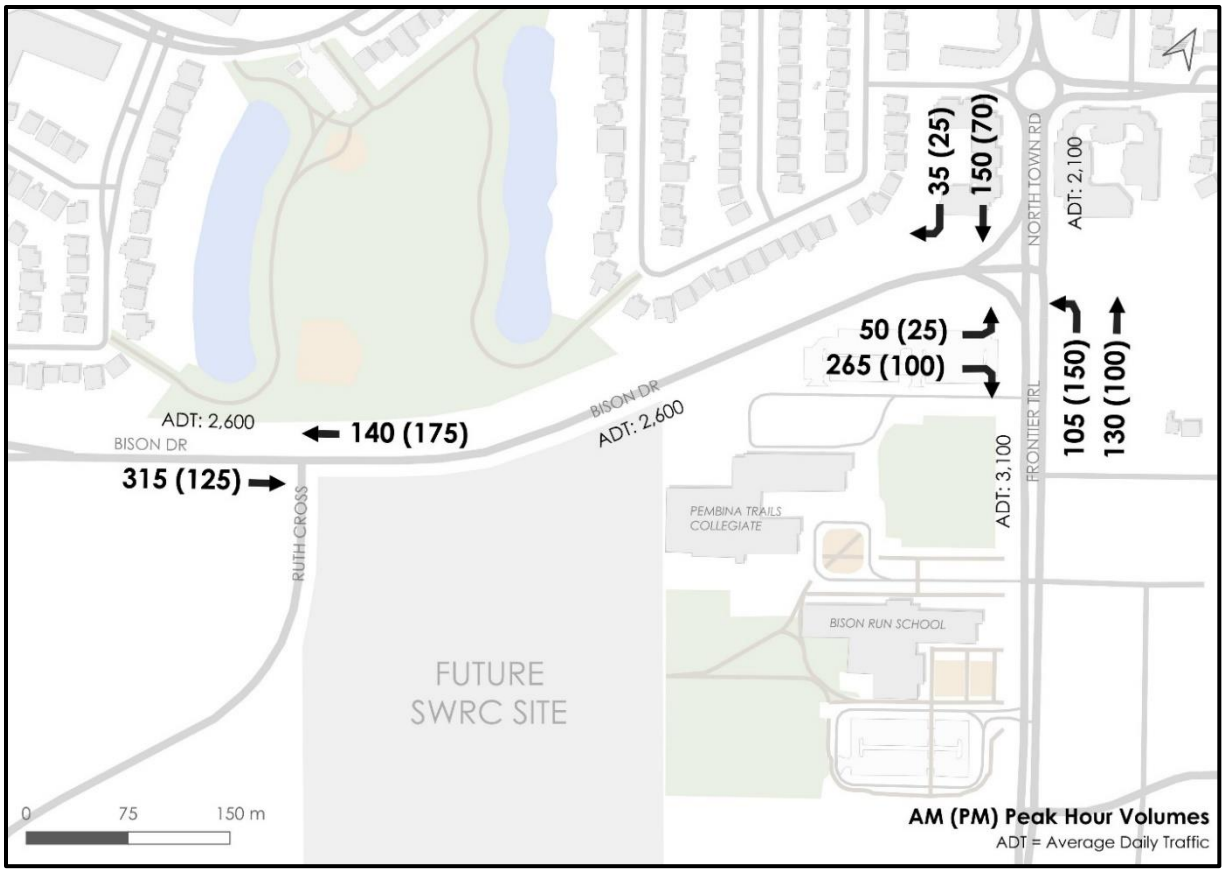


FIGURE 4: 2024 EXISTING CONDITION VOLUMES

Volumes were highest in the AM peak hour, which may reflect the influence of the two existing schools in an area that is still under development.

Peak Hour Factors and Heavy Vehicle Percentages

The counts allowed for calculation of peak hour factors (PHFs) at the intersection of Bison Drive and Frontier Trail. Those calculations showed PHFs of 0.61 in the AM peak hour, and 0.77 in the PM peak hour. Those peak hours are relatively low, representing higher than typical peaking within the peak hours. This is not surprising given the low traffic volumes—low volumes require less absolute change to show lower PHFs—and the presence of the schools in the area.

Pedestrians and Cyclists

Pedestrian crossing volumes were recorded at the intersection of Bison Drive and Frontier Trail. During the 12-hour count there were 20 pedestrian crossings in the north leg, 21 crossings in the south leg, and 228 crossings in the west leg. The time of day and direction of travel of pedestrians indicates that the schools are currently the primary source of pedestrian movements. Only one bicycle movement was recorded during the count.

3.2 Future Background Traffic Volumes

Future background traffic (traffic in the study area, but not related to SWRC) projections were prepared for 2027 and 2041 horizon years, to allow for analysis of the scenarios noted in Section 2.4. Projections were based on previously completed studies for the Waverley West B/Bison Run neighbourhood—the neighbourhood where SWRC will be located—as presented in the following documents:

- WSP's *Waverley West B Neighbourhood Transportation Impact Study* (February 2019)
- Stantec's *Waverley West Area B Trip Generation Update and Phase 1 Traffic Assignment* (January 2019)
- Stantec's *Traffic Impact Study: Phase 2 of Bison Run Community* (February 2022)

The documents included traffic projections to a 2041 horizon year, with Bison Run fully built out, and interim years with partial development. Note that while the WSP study was dated after the Stantec study on Phase 1, the WSP report was prepared for the City of Winnipeg using projected unit counts, while the Stantec study was prepared for the developer, using more up to date unit counts provided by the developer. The Stantec study was therefore taken as a more accurate representation of unit counts in Bison Run Phase 1. The Stantec Phase 2 study was also prepared for the developer, and was therefore taken as the most accurate representation of unit counts in Bison Run Phase 2. Unit counts for the remaining phases were taken from the WSP study, which considered the entirety of Bison Run.

The projections from the other studies needed to be modified for use in this TIS, for two reasons:

- The previous studies included traffic forecasts for the SWRC site based on plans available at the time. The SWRC forecasts were updated in this TIS based on the updated plans for SWRC. See Section 3.3. The SWRC forecasts from the other studies needed to be subtracted out to avoid double counting.
- When MORR conducted the traffic count at Bison Drive and Frontier Trail, parts of Bison Run Phase 1 were developed and occupied. This presented an opportunity to check the actual trip generation vs the forecasts in the other studies, such that the study projections for full build out could be adjusted.

The following points summarize the future background traffic projection process:

- 2041 background traffic volumes were calculated as the 2041 post-development volumes from the Stantec Phase 2 study—the reference with the most up to date unit counts for Bison Run—minus that studies projected volumes for the SWRC.
- 2041 background traffic volumes were adjusted based on the difference between the volumes in MORR's March 2024 traffic count and the expected traffic volume from the reference studies, calculated as the sum of:
    - WSP forecast 2041 volumes on Bison Drive without any development in Bison Run.

  - Stantec Bison Run Phase 1 volumes reduced to 33% of their full amount, based on MORR's assessment of the portion of Phase 1 units occupied at the time MORR's traffic count was conducted.
  - Stantec Bison Run Phase 1 school volumes reduced to 60% of their full amount, consistent with information provided by the School District on the school occupancy as of Spring 2024.

- Note that the MORR counted traffic volumes were greater than the prior study projected volumes, by the following amounts:
  - 50 to 75 vehicles per hour in the AM peak hour, at each of the study intersections.
  - 230 vehicles per hour at Bison Drive and Frontier Trail in the PM peak hour (approximately double the expected volume).
  - 140 vehicles per hour at Bison Drive and Ruth Crossing in the PM peak hour.
- 2041 background traffic volumes were adjusted by those differences, such that the background traffic volumes at Bison Drive and Frontier Trail were 230 vehicles higher than in the reference studies. The adjusted 2041 traffic volumes were approximately 5% higher than the reference study volumes in the AM peak hour, and 15% higher than the volumes for the PM peak hour.
  - Note that as of March 2024 there was no development to generate traffic on Joe Keeper Way, and no counts were conducted there, so no adjustment was possible. Forecast 2041 background traffic volumes on Joe Keeper Way east of Ruth Crossing—the segment that will have the future SWRC access—were taken from the Stantec Phase 2 study, with that study's forecast SWRC volume subtracted out.
- 2027 background traffic volumes were linearly interpolated between the 2024 and 2041 background traffic volumes.

The background traffic volumes in this TIS represented conditions with Bison Drive terminating at Frontier Trail. In the reference studies, the 2041 traffic projections assumed that Bison Drive was extended to Waverley Street. The 2041 traffic volumes from the reference studies were adjusted to represent conditions with Bison Drive terminating at Frontier Trail.

Existing daily traffic volumes were only 6.5 to 6.7 times the average of the AM and PM peak hour volumes—lower than typical for a residential area and likely reflecting the volume patterns for the schools in the area, where there is little traffic activity outside the peak hours. For the future scenarios, the area is expected to be more built out, and to see more traffic through the entire day. As such, daily volumes were estimated using larger factors than in the existing traffic counts: a factor of 7 for the 2027 scenario, and 9 for the 2041 scenario. Daily volumes were equal to the average of the AM and PM peak hour volumes, multiplied by the factors, such that the peak hour volumes were equivalent to 10 to 12% of the daily volume—in the typical range for residential areas.

None of the previous studies included forecast turning movement volumes to/from Rangeview Way, which forms the west leg of the SWRC access intersection on Ruth Crossing. Volumes turning to/from Rangeview Way were assumed to represent typical levels for local street activity.

Detailed background traffic calculations are included in Appendix B.

Figure 5 shows the forecast 2027 background traffic volumes, and Figure 6 shows the forecast 2041 background traffic volumes. On Joe Keeper Way the AM peak hour volumes are significantly higher than the PM peak hour volumes—an unusual pattern. That reflects the volumes from the Stantec Phase 2 study. No attempt was made to adjust those volumes.

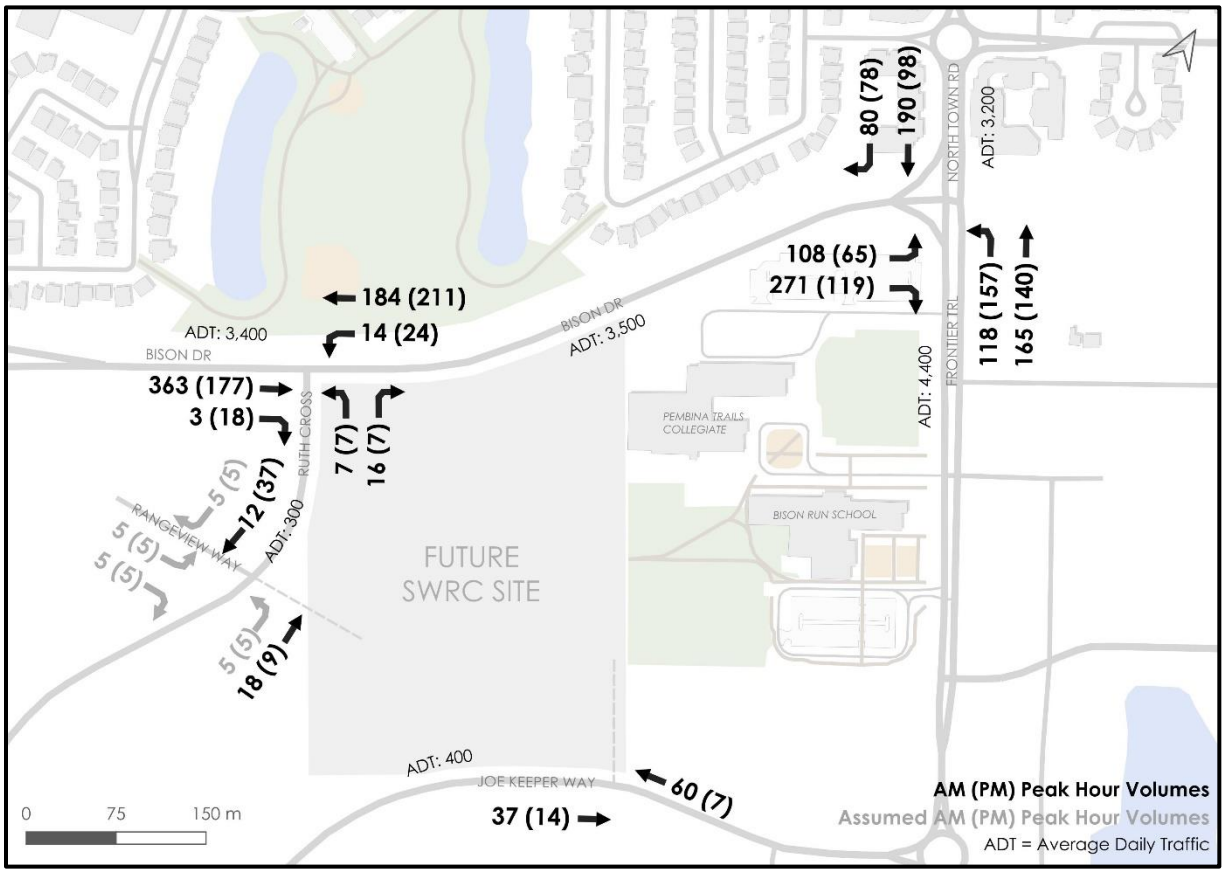


FIGURE 5: 2027 BACKGROUND TRAFFIC VOLUMES

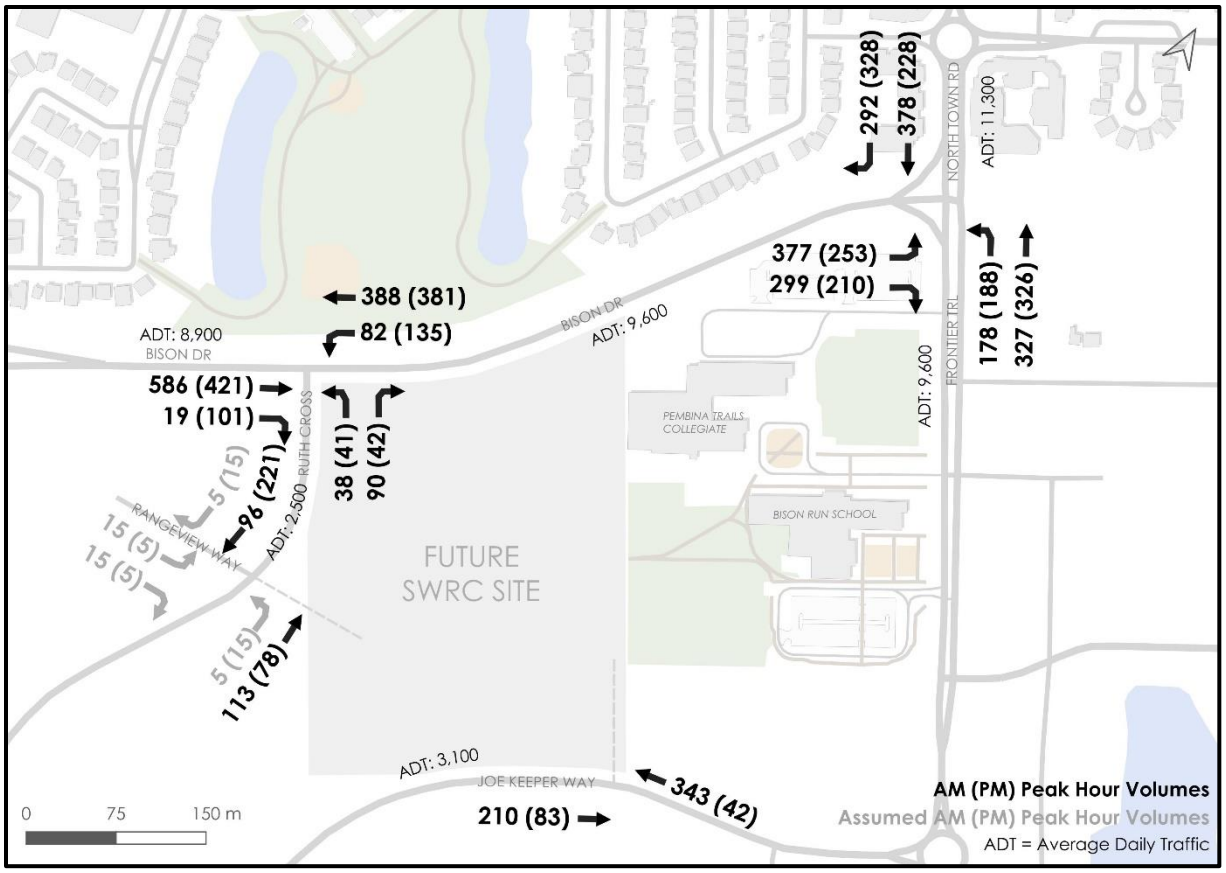


FIGURE 6: 2041 BACKGROUND TRAFFIC VOLUMES

3.3 Site Generated Traffic Volumes

SWRC site generated traffic was estimated using a four-step travel demand forecasting process:

1. Trip Generation – How many trips (and what kinds of trips) will the development generate?
2. Directional Distribution – Where will the trips be coming from and going to?
3. Mode Split – What modes of travel will be used?
4. Route Assignment – What intersection movements will the trips make to arrive at and leave from the development?

Note that estimates were prepared for the weekday AM and PM peak hours, and for weekday daily traffic. Estimates were prepared in terms of vehicle trips.

The following sections document the forecasting process, assumptions, and results.

3.3.1 Trip Generation

Vehicle trip generation was completed using data from the ITE *Trip Generation Manual, 11th Edition*, the industry standard reference for vehicle trip generation, with reference to available local data. The

combination of uses in the SWRC site creates potential for internal capture, where net external trip generation is less than the sum of trip generation for all uses. Internal capture calculations are described following Table 2.

SWRC Phase 1 is to include a rec centre, a childcare centre, an outdoor spray pad, and a fire station. The following points describe how trip generation rates were selected for those land uses:

- In Phase 1, the rec centre building is to have gymnasiums, multi-purpose rooms, an indoor walking track, and fitness space. The ITE *Recreational Community Centre* land use category (#495) includes source data from centres that include those facilities, but also daycares or nursery schools, swimming pools, saunas, racket sport courts, and restaurants or snack bars. The rec centre in Phase 1 has fewer features than the centres in the ITE data set, and as such the trip generation rate was seen as potentially being lower. To quantify this potential discrepancy, MORR conducted a traffic count at a community centre in Winnipeg with similar facilities to those proposed for the Phase 1 rec centre: the Winakwa Community Centre (WCC) in Windsor Park. Counts were conducted on Friday, October 18th and Saturday, October 19th, 2024. The counts found 101 vehicle movements to/from the site during the PM peak hour (3:00 PM to 4:00 PM). With a floor area of 20,700 ft^2, the resulting trip generation rate was 4.88 trips per 1,000 ft^2—nearly double the ITE average rate of 2.50 trips per 1,000 ft^2. The WCC is much smaller than the SWRC, and the trip generation rate per unit of floor area may not scale linearly with the size of the building.

  In the ITE data set, there were a group of centres with approximately 90,000 ft^2 floor area generating 3.5 to 4.5 PM trips per 1,000 ft^2 floor area, and one centre generating only 1 trip per 1,000 ft^2 floor area, for an average of 2.5 trips per 1,000 ft^2 floor area. The average rate is lower than most of the centres, while still higher than the low outlier site. Applying the average rate to Phase 1 gives a PM trip total of 225 PM trips, approximately 2.25 times the total at WCC, with 4.5 times as much building floor area. In MORR's judgement this is appropriate for Phase 1, given that it is not as fully featured as the sites in the ITE data set, and the resulting trip generation figure is higher than WCC, with a proportional increase less than the increase in floor area. MORR used the ITE average rate for the rec centre in Phase 1, for all time periods.

- For the childcare centre, trip generation was forecast using rates from the ITE *Daycare Center* category (#565). No adjustments were made, as the centre was similar in use to the ITE description.

- Trip generation for the outdoor spray pad was assumed to be included in the rec centre estimates. No separate estimates were prepared for the spray pad.

- For the fire station, the closest ITE land use category (#575 *Fire and Rescue Station*) had very limited data: three studies with widely varying rates. MORR developed trip generation rates assuming a shift change occurs during the peak hours, where 75% of the parking spaces turn over (with one trip out and one trip in per parking space). The resulting rates were 1.5 peak hour trips per parking space. That rate was used for the AM and PM peak hours. Daily trips were estimated

at 5 times the peak hour trip generation rates—representing off-peak shift changes and emergency response trips.

SWRC Phase 2 may add a library, an aquatic centre, indoor ice rinks, and outdoor sports facilities including tennis courts, basketball courts, a skate park, and soccer fields. The following points describe how trip generation rates were selected:

- For the library, MORR had a traffic count from the access to Transcona Library. Peak hour trip generation rates per 1,000 ft^2 floor area were approximately one quarter the ITE rates. The counts from Transcona Library were only conducted on a single day and could be lower than typical, but with such a large divergence, use of the ITE rates presents a risk of significantly overestimating trip generation. Trip generation rates were set to the rates from Transcona Library. The counts from Transcona Library did not cover the entire daily period, so daily trip generation was estimated using the ITE rates, factored down consistent with the ratio of Transcona Library trips to ITE trips from the peak hours.

- The aquatic centre fits into the uses listed in the description for the ITE *Recreational Community Centre* land use. Trips for the aquatic centre were estimated using the ITE trip generation rates for that land use.

- For the indoor ice rinks, the relevant ITE land use category is #465 *Ice Skating Rink.* Data for that category is limited, with only a single study for the AM peak hour, and five studies with varying trip generation rates for the PM peak hour. Trip generation was estimated using the ITE rates and checked against trip generation data from the Dakota Community Centre, which MORR had on hand from another project. The Dakota Community Centre includes a library, recreation centre, and ice rinks. That data showed 101 vehicles entering the site at the main entrance during the PM peak hour—exiting trips and trips from a secondary access were not counted. SWRC Phase 2 traffic from the same uses is forecast at 170 entering trips after accounting for internal capture (described below). Note that the SWRC rec centre, library, and ice rinks total to 185,000 ft^2, compared to 135,000 ft^2 at Dakota. SWRC entering trip generation is greater than the proportional increase in building floor area, but in MORR's opinion the increase is appropriate for planning purposes.

- Trips generated by the outdoor facilities were assumed to be incidental to the trip generation for the recreation centre.

Note that all ITE trip generation rates were taken from the "peak hour of adjacent street traffic" period, where it was provided.

Table 2 shows the vehicle trip generation estimates for Phase 1 and Phase 2.

TABLE 2: VEHICLE TRIP GENERATION ESTIMATES

Land Use (ITE Category)	Quantity	Trip Generation Rates	Trip Generation Estimates
SWRC Phase 1			
Recreation Centre (#495)	90,000 ft²	1.91 AM Trips per 1,000 ft², 66% in 2.50 PM Trips per 1,000 ft², 47% in 28.82 Weekday Trips per 1,000 ft², 50% in	172 AM Trips (114 in, 58 out) 225 PM Trips (106 in, 119 out) 2,594 Weekday Trips (1,297 in, 1,297 out)
Outdoor Spray Pad (N/A)			Included in Recreation Centre Trips
Childcare Centre (#565)	176 Childcare Spaces	0.78 AM Trips per 1,000 ft², 53% in 0.81 PM Trips per 1,000 ft², 47% in 4.09 Weekday Trips per 1,000 ft², 50% in	137 AM Trips (73 in, 64 out) 139 PM Trips (65 in, 74 out) 720 Weekday Trips (360 in, 360 out)
Fire Station (N/A)	25 Parking Spaces	1.50 AM Trips per space, 50% in 1.50 PM Trips per space, 50% in 9.00 Weekday Trips per space, 50% in	38 AM Trips (19 in, 19 out) 38 PM Trips (19 in, 19 out) 225 Weekday Trips (113 in, 112 out)
		Total Phase 1	347 AM Trips (206 in, 141 out) 402 PM Trips (190 in, 212 out) 3,502 Weekday Trips (1,751 in, 1,751 out)
SWRC Phase 2			
Library (N/A)	14,500 ft²	0.27 AM Trips per 1,000 ft², 71% in 2.47 PM Trips per 1,000 ft², 51% in 21.81 Weekday Trips per 1,000 ft², 50% in	4 AM Trips (3 in, 1 out) 36 PM Trips (18 in, 18 out) 316 Weekday Trips (158 in, 158 out)
Aquatic Centre (#495)	30,000 ft²	1.91 AM Trips per 1,000 ft², 66% in 2.50 PM Trips per 1,000 ft², 47% in 28.82 Weekday Trips per 1,000 ft², 50% in	57 AM Trips (38 in, 19 out) 75 PM Trips (35 in, 40 out) 865 Weekday Trips (433 in, 432 out)
Indoor Ice Rink (#465)	83,000 ft²	0.17 AM Trips per 1,000 ft², 37% in 1.33 PM Trips per 1,000 ft², 55% in 13.30 Weekday Trips per 1,000 ft², 50% in	14 AM Trips (5 in, 9 out) 110 PM Trips (61 in, 49 out) 1,104 Weekday Trips (552 in, 552 out)
Outdoor Facilities (N/A)			Included in Recreation Centre Trips
		Total Phase 2	75 AM Trips (46 in, 29 out) 221 PM Trips (114 in, 107 out) 2,285 Weekday Trips (1,143 in, 1,142 out)
		Total Phase 1 & Phase 2	422 AM Trips (252 in, 170 out) 623 PM Trips (304 in, 319 out) 5,787 Weekday Trips (2,894 in, 2,893 out)

In Phase 1, the SWRC is forecast to generate 347 vehicle trips during the AM peak hour, 402 vehicle trips during the PM peak hour, and 3,502 vehicle trips over a typical weekday.

After the additions in Phase 2, total SWRC vehicle trip generation is forecast at 422 vehicle trips in the AM peak hour, 623 vehicle trips in the PM peak hour, and 5,787 vehicle trips over a typical weekday.

Primary and Pass-By Trips

The land uses at SWRC do not typically see significant amounts of pass-by trips, so all vehicle trips generated by the development were assumed to be primary trips, with no pass-by trip generation.

Internal Trips

SWRC includes complementary land uses, so there may be internal trips that do not affect the external transportation network. The internal capture percentages were based on MORR's judgement, considering potential trips between the recreational uses in SWRC, the library, and the daycare centre. In MORR's judgement, there was little potential for internal trips in Phase 1, so internal capture reductions were only applied once Phase 2 was complete.

Table 3 shows the internal capture reductions applied to the gross vehicle trip estimates.

TABLE 3: INTERNAL CAPTURE AND EXTERNAL VEHICLE TRIPS

Trip Type	AM Peak Hour	PM Peak Hour	Weekday
SWRC Phase 1			
Internal Trips	0 (0%)	0 (0%)	0 (0%)
External Trips	347 (100%)	402 (100%)	3,502 (100%)
SWRC Phase 2			
Internal Trips	15 (3%)	43 (7%)	422 (7%)
External Trips	407 (97%)	580 (93%)	5,365 (93%)

With Phase 2 complete, internal capture was estimated to account for 3% of AM peak hour vehicle trips, 7% of PM peak hour vehicle trips, and 7% of weekday vehicle trips.

3.3.2 Directional Distribution

SWRC is intended to serve as a regional recreation hub, while also serving the immediate area. Trips were distributed by direction to the ends of the study area, assuming that patrons would be coming from the Waverley West area, and the larger southwest Winnipeg area. The same distribution was used for Phase 1 and Phase 2, and for all time periods.

Table 4 shows the directional distribution:

TABLE 4: DIRECTIONAL DISTRIBUTION

Direction	Percentage Distribution	AM Peak Hour Vehicle Trips	PM Peak Hour Vehicle Trips	Weekday Vehicle Trips
North on Frontier Trail	20%	81	116	1,073
South on Frontier Trail	10%	41	58	537
West on Bison Drive	25%	102	145	1,341
West on Joe Keeper Way	20%	81	116	1,073
East on Joe Keeper Way	25%	102	145	1,341

The largest distributions were to the west on Bison Drive—which connects Kenaston Boulevard and to parts of Waverley West—and to the East on Joe Keeper Way—which connects to Waverley Street and to parts of Waverley West—each with 25% of vehicle trips, or more than 100 vehicle trips in each peak hour. The

next highest distributions were 20% each to the north on Frontier Trail and to the west on Joe Keeper Way—routes that connect to Waverley Street and to Kenaston Boulevard, respectively, while also providing access to other parts of Waverley West.

3.3.3 Mode Split

SWRC was assumed to have vehicle trips represent a similar share of vehicle trip generation to the suburban-type developments that the ITE vehicle trip generation rates are based on. As such, no mode split adjustment was applied to the net (after internal capture reduction) vehicle trip generation estimates.

3.3.4 Route Assignment

The SWRC site is to include four access points for vehicle traffic:

- An access on Ruth Crossing, approximately 140 m south of Bison Drive.
- Two access on Ruth Crossing, exclusively for fire station use, approximately 80 m south of Bison Drive.
- An access on Joe Keeper Way, approximately 285 m west of Frontier Trail.

The accesses are intended to allow vehicle movements in both directions. For simplicity, the fire station accesses were ignored in the assignment. Trips were instead assigned to the access on Ruth Crossing and the access on Joe Keeper Way, with the split between accesses assigned based on the destinations in question. The site plan layout is not biased to one street or the other—the accesses on both streets provide direct connections to large parking areas and to the rec centre building.

Figure 7 shows the forecast development generated vehicle traffic volumes for Phase 1, and Figure 8 shows the volumes for Phase 2.

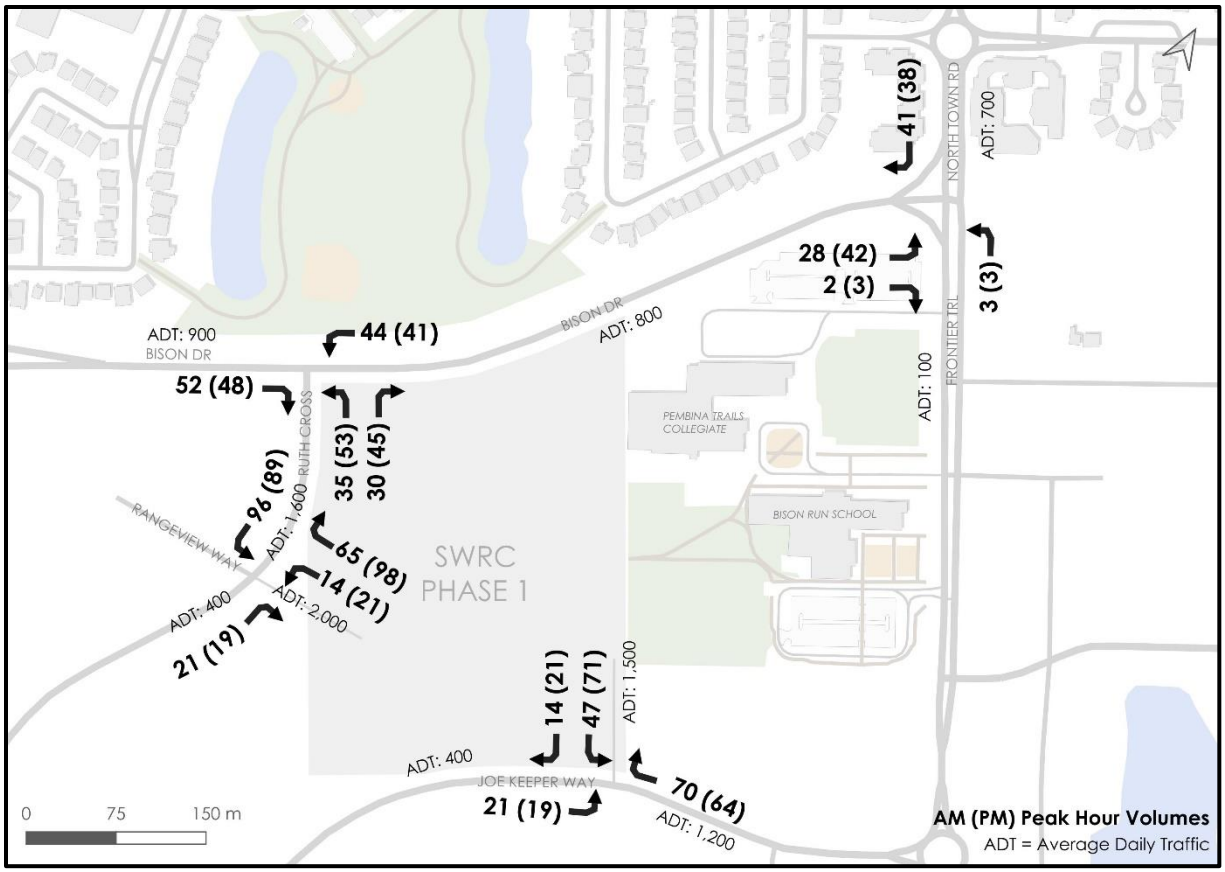


FIGURE 7: PHASE 1 DEVELOPMENT GENERATED TRAFFIC

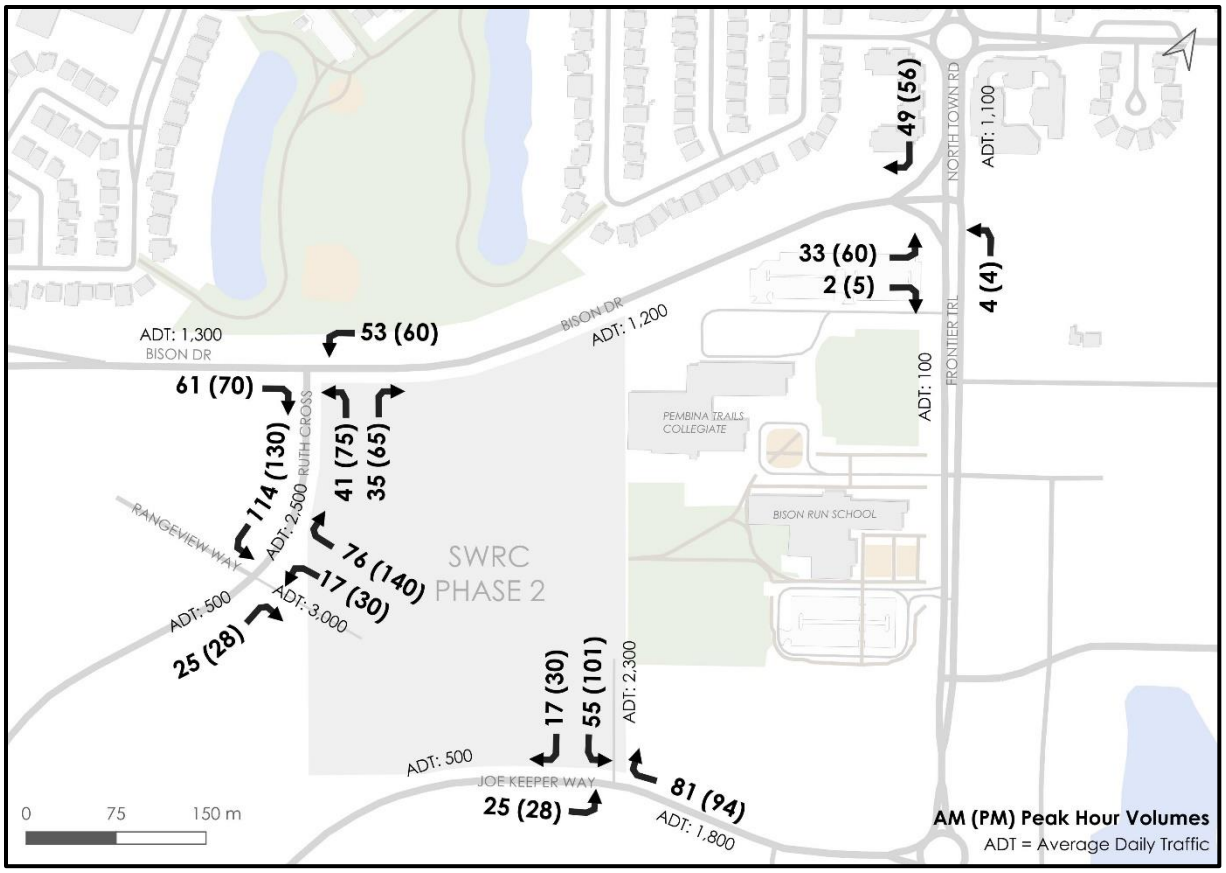


FIGURE 8: PHASE 2 DEVELOPMENT GENERATED TRAFFIC

3.4 Post-Development Traffic Volumes

Figure 9 shows the forecast 2027 post-development traffic volumes with SWRC Phase 1 developed, and Figure 10 shows the volumes for the 2041 post-development traffic volumes with SWRC Phases 1 and 2 developed.

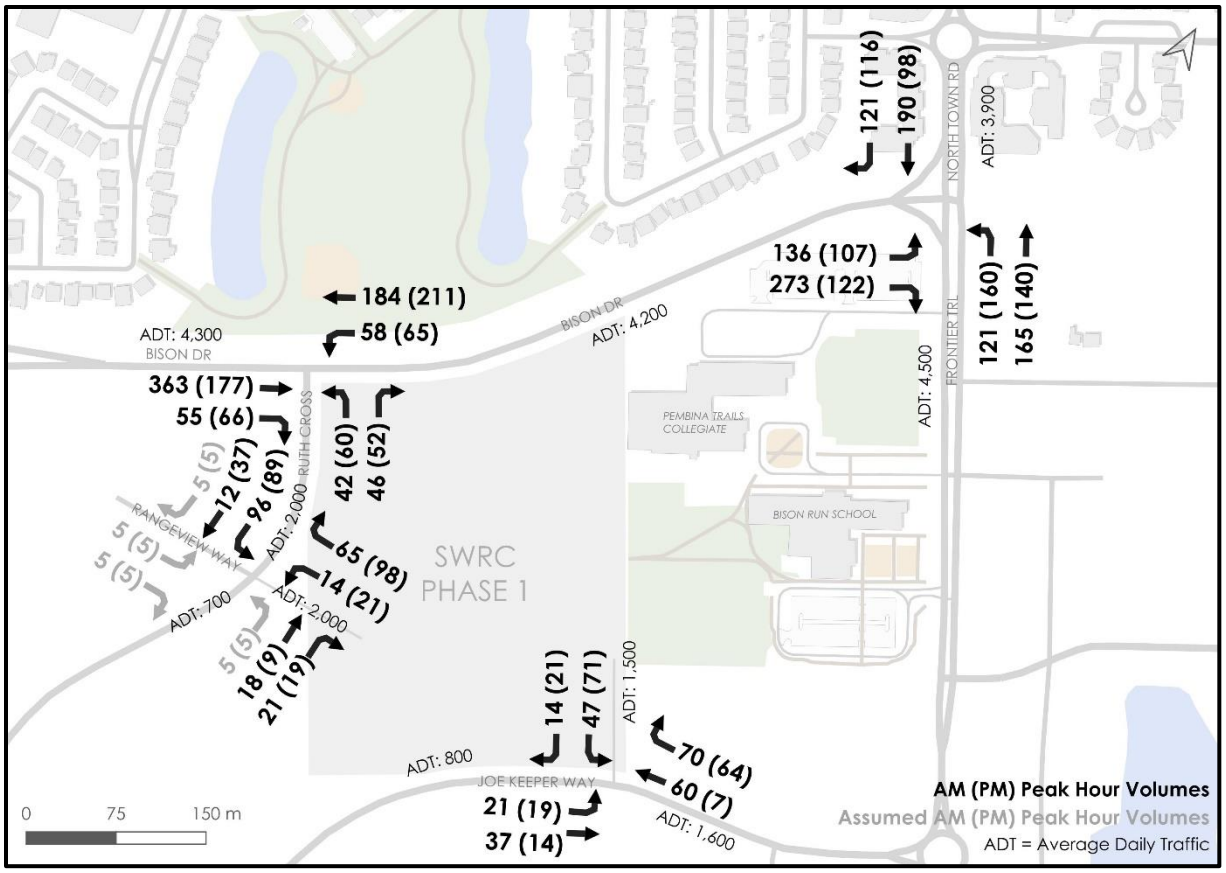


FIGURE 9: 2027 POST-DEVELOPMENT TRAFFIC VOLUMES

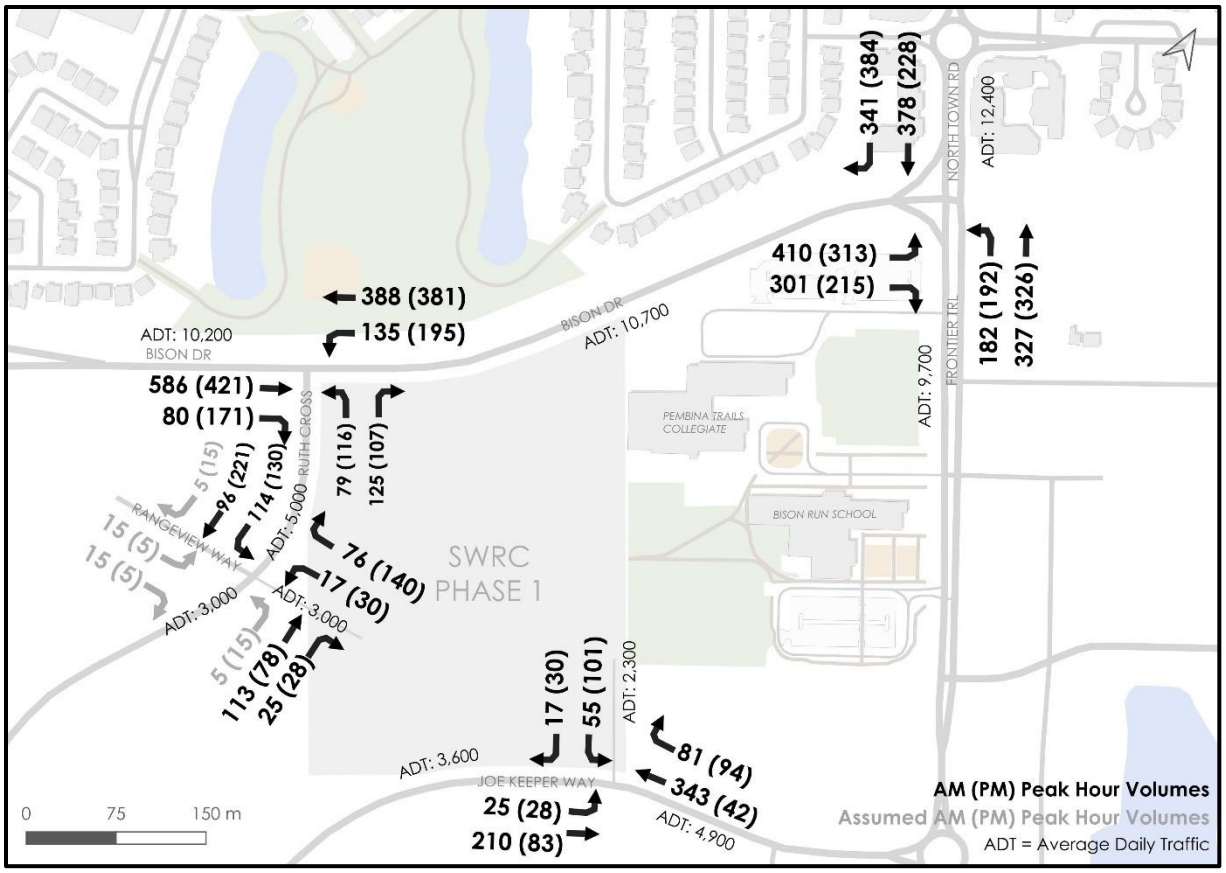


FIGURE 10: 2041 POST-DEVELOPMENT TRAFFIC VOLUMES

4 TRANSPORTATION ANALYSIS

Transportation impacts were identified through the following analyses:

- Traffic Operations Analysis to identify appropriate provisions for vehicle traffic at the study intersections.
- An Active Transportation Review to identify connections to the external active transportation (AT) network.
- A Site Plan Review to identify potential improvements to pedestrian, cyclist, and vehicle circulation within the site, and to evaluate the proposed parking and loading supply against By-law requirements and estimated demand.

The following section detail the processes, assumptions, and results of the analyses.

4.1 Traffic Operations Analysis

The traffic operations analysis included two parts:

1. Analysis of peak hour conditions based on the methodology outlined in the U.S. Transportation Research Board's *Highway Capacity Manual 2000* (HCM) using the *Synchro 9 Studio* software package. Synchro returned performance measures including Level of Service (LOS), delay, volume-to-capacity (v/c) ratio, and 95th percentile queue length estimates for each intersection approach.
2. Traffic signal warrant analyses (TSWAs) using the Transportation Association of Canada (TAC) methodology, which considers conflicting traffic volumes over the peak six hours of the day.

This section and following subsections detail the assumptions, process, and results of the peak hour analysis. The TSWAs are discussed in Section 4.1.2.

4.1.1 Peak Hour Traffic Operations Analysis

Performance is reported for individual intersection movements in terms of LOS, delay, v/c ratio, and 95th percentile queue lengths. Performance is only shown for "notable movements", defined as:

- Movements that are nearing capacity (with a v/c ratio of 0.85 or more) or experiencing significant delay (LOS E or worse)
- Movements to/from Ruth Crossing at Bison Drive—the movements leading to/from SWRC
- Movements to/from the SWRC accesses on Ruth Crossing and Joe Keeper Way

The analysis was completed for the following scenarios:

- 2024 Existing Conditions
- 2027 Background Conditions

- 2041 Background Conditions
- 2027 Phase 1 Post Development Conditions
- 2041 Phase 2 Post-Development Conditions

Detailed analysis reports are included in Appendix C.

The following assumptions were used in the analysis:

- Saturated flow rates were set to a default value of 1,900 vehicles per hour per lane (vphpl).
- Operating speeds were set to the posted speed limits.
- Peak hour factors (PHFs) and heavy vehicle percentage were set to the values derived from the intersection counts. For the 2041 scenarios, PHFs were set to a typical value of 0.92, and for the 2027 scenarios, PHFs were interpolated between the 2024 PHFs and 0.92 PHFs for the 2041 scenarios.
- Heavy vehicle percentages were set to values calculated from the traffic counts.
- Pedestrian crossing volumes at Bison Drive and Frontier Trail were set equal to values from the traffic counts. Volumes were increased for the future scenarios, representing increased pedestrian activity as the Waverley West area develops.

Existing Intersection Configurations

The analysis began with the 2024 existing conditions scenario, with an analysis model including the two study intersections noted in Section 2.2. The intersections were modeled in their existing configurations, which included:

- Bison Drive at Frontier Trail
  All-way stop controlled, "T" intersection with north, south, and west legs. The eastbound approach having a shared left-turn and through lane, plus a channelized right-turn lane. The right-turn lane was modeled separately, with 15 m storage to represent the length where right-turning vehicles can avoid queues in the left-turn/through lane. The southbound approach had a similar configuration, with 10 m storage for the right-turn channel. The northbound approach had a left-turn lane with 45 m storage, plus a through lane.
- Bison Drive at Ruth Crossing
  Minor-road stop-controlled "T" intersection with east, west, and south legs. All approaches had a single lane with shared turns.

The SWRC access intersections did not exist as of 2024, so they were only considered in the post-development scenarios. They were modeled initially as minor-road stop-controlled intersections, with a single lane on each approach, and modified as required to address any unacceptable performance.

Analysis Results

Table 5 shows the analysis results for the 2024, 2027, and 2041 background scenarios.

TABLE 5: PEAK HOUR TRAFFIC OPERATIONS ANALYSIS RESULTS – BACKGROUND SCENARIOS

Intersection	Overall Intersection Performance (LOS / Delay)	Notable Movement Performance (Movement / LOS / Delay / v/c Ratio / 95th. Pctl. Q.)
2024 Existing Conditions		
Bison Dr & Frontier Trail	A / 9 (A / 8)	All movements LOS D or better, v/c ratio < 0.85 (All movements LOS D or better, v/c ratio < 0.85)
Bison Dr & Ruth Cr	A / 1 (A / 1)	EB / A / 0 / 0.23 / 0 m WB / A / 2 / 0.01 / 0 m NB / B / 12 / 0.04 / 5 m (EB / A / 0 / 0.12 / 0 m) (WB / A / 2 / 0.02 / 0 m) (NB / B / 11 / 0.02 / 0 m)
2027 Background Conditions		
Bison Dr & Frontier Trail	B / 10 (A / 9)	All movements LOS D or better, v/c ratio < 0.85 (All movements LOS D or better, v/c ratio < 0.85)
Bison Dr & Ruth Cr	A / 1 (A / 1)	EB / A / 0 / 0.23 / 0 m WB / A / 2 / 0.01 / 0 m NB / B / 12 / 0.04 / 5 m (EB / A / 0 / 0.12 / 0 m) (WB / A / 2 / 0.02 / 0 m) (NB / B / 11 / 0.02 / 0 m)
2041 Background Conditions		
Bison Dr & Frontier Trail	F / 83 (D / 29)	EBL / F / 146 / 1.24 / - NBT / F / 109 / 1.13 / - SBT / F / 141 / 1.22 / - (NBT / F / 69 / 1.02 / -)
With Traffic Signal Control	*D / 48* *(C / 20)*	*EBL / E / 61 / 0.96 / 110 m* *NBL / E / 79 / 0.98 / 45 m* *SBT / D / 47 / 0.89 / 100 m* *SBR / D / 55 / 0.90 / 65 m* *(All movements LOS D or better, v/c ratio < 0.85)*
Bison Dr & Ruth Cr	A / 4 (A / 4)	EB / A / 0 / 0.00 / 0 m WB / A / 3 / 0.10 / 5 m NB / D / 26 / 0.45 / 15 m (EB / A / 0 / 0.00 / 0 m) (WB / A / 4 / 0.15 / 5 m) (NB / D / 26 / 0.35 / 10 m)

The intersections on Bison Drive provided good operations in their existing configurations, except in the 2041 background scenario, where the intersection of Bison Drive and Frontier Trail had multiple movements over capacity in the AM peak hour. Adding traffic signal control allowed all movements to

operate at or below capacity, but some movements were very close to capacity. Even with traffic signal control, the intersection was full.

Table 6 shows the analysis results for the 2027 and 2041 post-development scenarios, which included the intersections on Bison Drive and the SWRC access intersections.

TABLE 6: PEAK HOUR TRAFFIC OPERATIONS ANALYSIS RESULTS – POST-DEVELOPMENT SCENARIOS

Intersection	Overall Intersection Performance (LOS / Delay)	Notable Movement Performance (Movement / LOS / Delay / v/c Ratio / 95th. Pctl. Q.)
2027 Phase 1 Post-Development Conditions		
Bison Dr & Frontier Trail	B / 10 (A / 9)	All movements LOS D or better, v/c ratio < 0.85 (All movements LOS D or better, v/c ratio < 0.85)
Bison Dr & Ruth Cr	A / 3 (A / 3)	EB / A / 0 / 0.27 / 0 m WB / A / 2 / 0.06 / 5 m NB / B / 15 / 0.21 / 5 m (EB / A / 0 / 0.16 / 0 m) (WB / A / 2 / 0.05 / 0 m) (NB / B / 13 / 0.22 / 5 m)
Ruth Cr & SWRC Access	A / 6 (A / 7)	NB / A / 1 / 0.00 / 0 m SB / A / 6 / 0.07 / 0 m WB / A / 9 / 0.09 / 5 m (NB / A / 1 / 0.00 / 0 m) (SB / A / 5 / 0.06 / 5 m) (WB / A / 9 / 0.14 / 5 m)
Joe Keeper Way & SWRC Access	A / 3 (A / 5)	EB / A / 3 / 0.02 / 0 m WB / A / 0 / 0.08 / 0 m SB / A / 9 / 0.08 / 5 m (EB / A / 4 / 0.01 / 0 m) (WB / A / 0 / 0.05 / 0 m) (SB / A / 9 / 0.11 / 5 m)

Intersection	Overall Intersection Performance (LOS / Delay)	Notable Movement Performance (Movement / LOS / Delay / v/c Ratio / 95th. Pctl. Q.)
2041 Phase 2 Post-Development Conditions		
Bison Dr & Frontier Trail With Traffic Signal Control	E / 58 (C / 27)	EBL / F / 87 / 1.05 / 120 m NBL / F / 81 / 0.99 / 40 m SBR / F / 82 / 1.02 / 80 m (EBL / D / 43 / 0.91 / 60 m) (SBR / D / 38 / 0.88 / 30 m)
Bison Dr & Ruth Cr	C / 15 (D / 34)	EB / A / 0 / 0.00 / 0 m WB / A / 4 / 0.17 / 5 m NB / F / 96 / 0.97 / 65 m (EB / A / 0 / 0.00 / 0 m) (WB / A / 5 / 0.23 / 5 m) (NB / F / 198 / 1.25 / 100 m)
With Two-Stage Left-Turns	A / 6 (A / 8)	EB / A / 0 / 0.00 / 0 m WBL / A / 9 / 0.17 / 5 m NB / D / 31 / 0.63 / 30 m (EB / A / 0 / 0.00 / 0 m) (WBL / A / 9 / 0.23 / 5 m) (NB / E / 42 / 0.74 / 45 m)
With Traffic Signal Control + Westbound Left-Turn Lane	*B / 11* *(B / 12)*	*EB / B / 11 / 0.74 / 85 m* *WBL / B / 11 / 0.60 / 25 m* *NB / B / 16 / 0.38 / 30 m* *(EB / B / 11 / 0.68 / 75 m)* *(WBL / C / 20 / 0.76 / 50 m)* *(NB / B / 16 / 0.50 / 45 m)*
Ruth Cr & SWRC Access	A / 5 (A / 5)	NB / A / 0 / 0.00 / 0 m SB / A / 5 / 0.09 / 5 m WB / B / 11 / 0.13 / 5 m (NB / A / 1 / 0.01 / 0 m) (SB / A / 3 / 0.10 / 5 m) (WB / B / 12 / 0.26 / 10 m)
Joe Keeper Way & SWRC Access	A / 2 (A / 4)	EB / A / 1 / 0.02 / 0 m WB / A / 0 / 0.27 / 0 m SB / C / 15 / 0.18 / 5 m (EB / A / 2 / 0.02 / 0 m) (WB / A / 0 / 0.09 / 0 m) (SB / B / 11 / 0.19 / 5 m)

In the 2027 Phase 1 post-development scenario the existing intersections on Bison Drive and simple single lane, minor-road stop control intersections at the SWRC accesses provided good performance.

In the 2041 scenario with Phase 2 developed, the intersection of Bison Drive and Frontier Trail was assumed to have traffic signal control, the treatment required for the 2041 background scenario. The intersection was slightly over capacity, with delays somewhat increased vs the 2041 background scenario.

The intersection of Bison Drive and Ruth Crossing was over capacity on the northbound approach in the PM peak hour. The segment of Bison Drive further west has a divided section—if the median was extended east through the intersection with Ruth Crossing such that northbound left-turn vehicles could make two stage left turns, performance would improve significantly. In that condition the intersection was assumed to include a westbound left-turn lane. Performance could also be improved through the addition of traffic signal control, with an assumed westbound left-turn lane added.

In both post-development scenarios both SWRC access intersections provided good traffic operations performance with simple minor-road stop-controlled intersections with single lane approaches.

4.1.2 Traffic Signal Warrant Analysis

The peak hour traffic operations analysis found that traffic signals would be required at the intersection of Bison Drive and Frontier Trail in the 2041 background traffic scenario. Need for traffic signals was also evaluated using the Transportation Association of Canada (TAC) Traffic Signal Warrant Analysis (TSWA) procedure.

The TSWA process uses peak six-hour traffic volumes, including two hours in the morning, two hours at mid-day, and two hours in the afternoon. The analysis uses a spreadsheet process that returns a number of "warrant points", where 100 or more warrant points indicate that the conflicting traffic volumes warrant traffic signal control. The analysis also considers pedestrian crossing volumes, and contextual factors including area population, proximity to schools, lane configurations and speed limits, etc.

Large volumes of traffic on the major road can lead the analysis to return a high number of warrant points even where the minor road has low traffic volumes. Traffic signals are usually considered not warranted where the traffic volume on the minor roads averages fewer than 75 vehicles per hour (vph) over the peak six hours. In Winnipeg, this is interpreted as the volume of minor road left turns and through movements, as traffic signals are considered not an appropriate treatment to provide capacity for minor road right turns.

TSWAs were completed for the study intersections on Bison Drive. Analyses were not completed for the SWRC accesses, as they had significantly lower traffic volumes. Analyses were completed at the Bison Drive intersections for each of the analysis scenarios listed in Section 2.4. Additional sensitivity analyses were completed to determine the horizon year between 2024 and 2041 where traffic signals might first become warranted, assuming linear growth in background traffic between those years, and Phase 1 SWRC traffic in 2027 through to 2041.

The traffic volume estimates presented in Section 3 included estimates for weekday AM peak hour, PM peak hour, and daily time periods, but not peak six-hour periods. Peak six-hour volumes were estimated using the traffic count data noted in Section 3.1, which covered the period from 7:00 AM to 7:00 PM. An adjustment factor was calculated as the peak six-hour intersection volume divided by the sum of the AM and PM peak hour intersection volumes. This allowed the peak hour traffic volumes for all the scenarios to be expanded to peak six-hour estimates.

The expansion factor from the count at Bison Drive and Frontier Trail was 1.64, indicating that peak six-hour traffic was 64% greater than the sum of the traffic in the AM and PM peak hours. This was notably

low—peak six-hour expansion factors in suburban residential areas are typically between 2.25 and 2.75. This is not surprising given that the two schools were the main thing developed around the intersection, and schools have a distinct time of day volume pattern that is somewhat different than residential land uses.

The 1.64 expansion factor was used to estimate peak six-hour volumes for the 2024 existing conditions scenario, but the factor was modified for the 2027 and 2041 scenarios, to represent a more built out area. Factors were calculated using counts on hand from the intersection of Waverley Street and Lee Boulevard, and Lee Boulevard and Keslar Road. Those factors were 2.72 and 2.49, respectively. Waverley Street has a greater reach than Bison Drive—at least until Bison Drive is extended to Waverley Street, which is outside the scope of this study—Lee Boulevard and Keslar Road both have less extensive reach. As such, the factors were averaged to give a factor of 2.60 for use in the 2041 scenarios, when Waverley West is assumed to be fully built out. For the 2027 scenarios, the factor was linearly interpolated between 1.64 in 2024 and 2.60 in 2041, for a value of 1.80.

Pedestrian crossing volumes were increased in the 2027 and 2041 scenarios, representing increased pedestrian traffic resulting from the increased development in Waverley West. Crossing volumes are shown on the analysis sheets in Appendix D.

Table 7 shows the warrant points returned from the analyses.

TABLE 7: TRAFFIC SIGNAL WARRANT ANALYSIS RESULTS

Scenario	Warrant Points (100 to Warrant)	Minor Road Volume [vehicles per hour, average over peak six hours] (75 to Warrant)	Warrant Conditions Met?
Bison Drive at Frontier Trail			
2024 Background	18	21	No
2027 Background	34	52	No
2041 Background	269	273	Yes
2027 Phase 1 Post-Development	41	73	No
2041 Phase 2 Post-Development	301	313	Yes
Bison Drive at Ruth Crossing			
2024 Background	N/A	0	No
2027 Background	3	4	No
2041 Background	56	34	No
2027 Phase 1 Post-Development	12	31	No
2041 Phase 2 Post-Development	112	85	Yes

At Bison Drive and Frontier Trail, traffic signals were warranted in the 2041 background and Phase 2 post-development scenarios. The addition of traffic from SWRC Phase 2 increased the volume of conflicting

traffic—and thus the need for signalization—but it did not create a warrant condition that wasn't already present due to background traffic. Sensitivity analyses indicated that development of SWRC would not significantly impact the horizon year when signals would first become warranted—signals were forecast to be warranted in 2032 with SWRC Phase 1, and in 2033 without SWRC Phase 1.

At Bison Drive and Ruth Crossing, traffic signals were only warranted in the 2041 Phase 2 post-development scenario. Sensitivity analyses found that development of SWRC Phase 2 was required to create the warrant for signals—2041 background traffic plus SWRC Phase 1 traffic returned 87 warrant points, short of the 100 points required to indicate that signalization was warranted.

The TSWA findings were consistent with the results of the peak hour traffic operations analysis, though the 2041 post-development peak hour condition at Bison Drive and Ruth Crossing could also be addressed through a median allowing two-stage left-turns—it would not necessarily require traffic signals to provide good peak hour traffic operations performance.

4.2 Active Transportation Review

The site plan includes path connections to Bison Drive, Ruth Crossing, and Joe Keeper Way. The active transportation review considered the need for crossing control where those paths cross the roads, and needs for any new or additional paths outside the SWRC site. Path provisions inside the site are included under the site plan review, in Section 4.3.

The need for crossing control was evaluated using the procedure from the TAC *Pedestrian Crossing Control Guide, 3rd Edition*. The *Guide* provides a decision support tool to determine if a crossing is a candidate for control, and a treatment selection matrix to provide advice on control treatments for those crossings that are candidates for crossing control.

With reference to the decision support tool and treatment selection matrix, MORR found:

- Hourly pedestrian volumes were unknown, given that the area is developing and SWRC is not yet developed. Consideration for control was based on requirements for system connectivity, rather than quantified crossing demand.
- There are two path connections to Bison Drive and the recreational area to the north: one 75 m east of Ruth Crossing, and another 160 m east of Ruth Crossing. Both can be considered as key system connections, as they will connect the SWRC and surrounding neighbourhood with a park on the north side of Bison Drive.
    - With the potential for future signalization at Bison Drive and Ruth Crossing, the decision support tool indicates that the crossing 160 m east of Ruth Crossing is a better location for control, as it is at least 100 m away from the potential future control at that intersection. That path alignment is also closer to the building doors, making it more convenient for pedestrians.

  - With Bison Drive in its existing configuration, with a single lane in each direction, no median, and a 50 km/h speed limit, side mounted signs are an appropriate treatment, per the treatment selection matrix.
  - Bison Drive has a wide right-of-way, little visual friction, and few intersections, so vehicle speeds may frequently exceed 50 km/h. The treatment selection matrix indicates that with a posted speed of 60 km/h—which may be more representative of typical speeds on Bison Drive—an appropriate treatment is enhanced side mounted signs for the 2027 scenarios (with forecast daily traffic volumes of to 4,200 vehicles per day), and rectangular rapid flashing beacons (RRFBs) for the 2041 scenarios (with forecast daily traffic volumes of 10,700 vehicles per day). RRFBs are shown as appropriate where vehicle volumes exceed 9,000 vehicles per day.
  - In MORR's judgement, a controlled crossing should use RRFBs, given the expectation that traffic volumes will reach levels consistent with RRFB use, per the *Guide*. Note that if Bison Drive were widened to a four-lane divided section, the matrix indicates that RRFBs should be used with 2027 and 2041 daily traffic volumes.

- There are path connections to Ruth Crossing, at the SWRC access across from Rangeview Way. This crossing can be considered a requirement for system connectivity, as it would connect the neighbourhood west of Ruth Crossing to the SWRC site. Further, the crossing is 140 m south of potential future traffic signal control at Bison Drive, an acceptable offset as it exceeds 100 m, per the decision support tool.
  - With a single lane in each direction on Ruth Crossing, no median, a posted speed limit of 50 km/h, and forecast post-development daily traffic volumes of 2,000 vehicles per day in 2027 and 5,000 vehicles per day in 2041, the treatment selection matrix indicates that side mounted signs are the appropriate treatment.
  - In MORR's judgement, a crossing with side mounted signs is appropriate for the context. Whether the crossing is on the north or south side or constructed as a raised or at road level can be determined by the City later based on observed need.

- Concrete sidewalks are provided on either side of the drive aisle connecting to Joe Keeper Way. Transit stops are located just west of the Joe Keeper access. Transit's June 2025 network plan indicates that continued operation of the transit route on Joe Keeper Way is subject to funding. Residential development is expected on the south side of Joe Keeper Way. Depending on the continued operation of transit and the density and form of residential development on the south side of Joe Keeper Way there is a potential requirement for system connectivity for pedestrians. Spacing to control devices on Joe Keeper Way (roundabouts to the east and west) exceeds 100 m.
  - Joe Keeper Way has one travel lane and one parking lane in each direction, with no median and a 50 km/h posted speed limit. The treatment selection matrix indicates that enhanced side mounted signs are the appropriate treatment, given forecast traffic volumes of 800 vehicles per day in 2027 and 3,600 vehicles per day in 2041.

- If curb extensions were installed to narrow the crossing distance to a single lane in each direction, the treatment selection matrix indicates that side mounted signs would remain an appropriate form of control, even if traffic volumes were to increase to more than 9,000 vehicles per day.
- In MORR's judgement, pedestrian crossing control on Joe Keeper Way is a consideration to monitor pending future transit, future development, and future traffic volumes on Joe Keeper Way.

Active transportation provisions planned for Bison Drive, Ruth Crossing, and Joe Keeper Way are extensive, including a multi-use path on the south side of Bison Drive, and multi-use paths on the near sides of Ruth Crossing and Joe Keeper Way. MORR did not identify any external active transportation links that should be added to integrate SWRC with the surrounding network.

4.3 Site Plan Review

The site plan review was intended to identify changes to the site plan to allow the site to provide better and safer functionality. The review considered:

- Provisions for parking and loading as shown on the site plan, vs Winnipeg's *Zoning By-law 200/2006* and forecasts of parking and loading demand.
- Circulation of pedestrians, cyclists, and vehicles within the site.
- Geometry requirements for large vehicles, including garbage trucks, fire trucks, and school buses.

The following sections present the findings in each area.

4.3.1 Parking and Loading

Winnipeg's *Zoning By-law 200/2006* lays out requirements for the minimum supply of parking for different types of land uses. Requirements are shown in By-law Table 5-9. Requirements relevant to SWRC include:

- Recreation centres—including aquatic centres and ice rinks—(Parking Category 12): 1 stall per 100 ft^2 floor area.
- Childcare centres (Parking Category 5): 1 stall per 10 children in care, plus 1 per 3 staff at maximum shift.
- Fire stations (Parking Category 17): 1 stall per 550 ft^2 floor area, but not less than 2 spaces.
- Libraries (Parking Category 9): 1 stall per 1,000 ft^2 floor area, but not less than 2 spaces.

The By-law includes allowances for 20% reductions in "urban infill areas" with transit service on adjacent streets, and for sites with buildings that combine multiple uses. The first does not apply to SWRC, as it is outside the area, but the second does.

By-law Minimum Parking Requirements vs Site Plan

Table 8 shows the By-law parking requirements applied to SWRC in Phase 1 and Phase 2. Note that the requirements for the fire station are shown separately, as it has a dedicated parking supply, and it is on a separate property from the rest of the SWRC. Further, the requirements for Phase 2 assume that the aquatic centre, ice rinks, and library are connected to the Phase 1 rec centre building, to qualify for the combined use reduction.

TABLE 8: BY-LAW PARKING REQUIREMENTS

Component	By-Law Minimum Supply Rate	Quantity	Minimum Stalls Required
SWRC Phase 1			
Recreation Centre	0.8[A] stalls per 100 ft^2 floor area	90,000 ft^2	720 stalls
Childcare Centre	0.8[A] guest stall per 10 children in care, plus 0.8[A] per 3 staff at maximum shift	176 children in care 33[B] staff at peak shift	23 stalls (14 guest stalls) (9 stall staffs)
		TOTAL	743 stalls
SWRC Phase 1 & Phase 2			
Recreation Centre (+ Aquatic Centre) (+ Ice Rinks)	0.8[A] stalls per 100 ft^2 floor area	203,000 ft^2	1,624 stalls
Childcare Centre	0.8[A] guest stall per 10 children in care, plus 0.8[A] per 3 staff at maximum shift	176 children in care 33[B] staff at peak shift	23 stalls (14 guest stalls) (9 stall staffs)
Library	0.8[A] stall per 1,000 ft^2 floor area	14,500 ft^2	12 stalls
		TOTAL	1,659 stalls
Fire Station			
Fire Station	1 stall per 550 ft^2, but not less than 2 spaces	11,300 ft^2	21 stalls

[A] Rate after 20% reduction for combined uses in one building.

[B] Assumed staff at peak shift, staff to child ratio from another project.

The By-law requires at least 743 stalls for SWRC Phase 1, and 1,659 stalls after the addition of Phase 2. The proposed site plan for Phase 1 includes a supply of 451 parking stalls, well short of the By-law requirement. Note that the fire station has a dedicated parking area with 25 stalls, which exceeds the By-law requirement for 21 stalls.

By-law Parking vs Reference Sites

The By-law requirements for rec centre parking were compared to actual parking supply ratios at several recreation and community centres and one YMCA/YWCA in Winnipeg. Figure 11 shows the comparison, including the proposed parking supply ratio per the SWRC site plan.

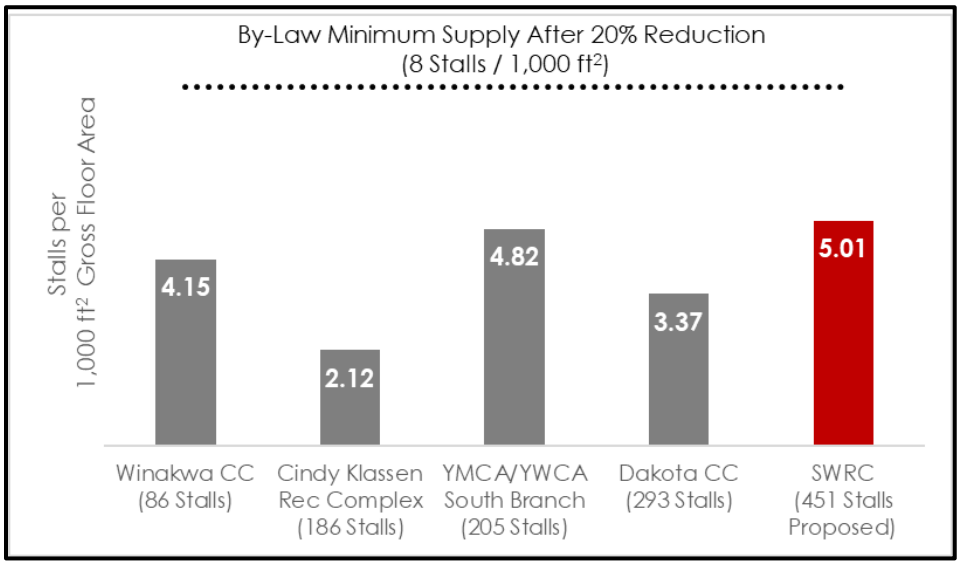


FIGURE 11: PARKING SUPPLY RATIOS AT REFERENCE SITES

The four existing centres considered had parking supplied at rates well below the By-law requirement. The 5.01 stalls per 1,000 ft^2 floor area proposed for SWRC was more generous than the provisions at any of those sites.

By-law Requirements for Accessible Stalls and Bike Parking

By-law Table 5-10 provides minimum requirements for accessible stalls, based on the total parking supply. For Phase 1, the requirement is 2% of the total minimum supply required, or 15 stalls. For Phase 2, the requirement is 20 stalls, plus 1 for every hundred stalls in excess of 1,000 stalls required, for a total requirement of 26 accessible stalls. The site plan shows 15 accessible stalls for Phase 1—equal to the By-law requirement. In Phase 2, 11 additional accessible stalls would be required. Note that the site plan does not show curb ramps for the accessible parking stalls at the north edge of the parking lot—ramps should be added there.

The By-law does not speak to requirements for electric vehicle (EV) parking stalls. In MORR's opinion, the supply and location of EV stalls seems appropriate, though the two isolated stalls in the southwest corner of the lot should be moved into one of the other two groupings. This should allow the electrical infrastructure to be more concentrated.

By-law Clause 169 indicates that one lockable bike parking space must be provided for every 10 vehicle parking stalls required. This equates to 77 spaces for Phase 1, and 168 spaces for Phase 2. The site plan for Phase 1 shows 31 bike parking stalls—short of the By-law requirement. No assessment of bike parking demand has been made so it is recommended that an area for additional bike racks be identified but that

installation be tailored to actual demand. Any additional bike parking stalls should be located close to the building doors, in locations with passive surveillance from foot traffic and people in the building.

By-law Loading Requirements ("Goods Loading")

Loading requirements in the By-law have to do with the loading of goods, in contrast to dropping off or picking up guests ("people loading"). People loading is discussed under the "Forecast Loading Demand" heading.

Table 5-13 indicates that sports facilities with floor areas between 10,000 ft^2 and 200,000 ft^2 must have at least one loading space—MORR considered this to apply to SWRC. The same requirement applies to the Library in Phase 2.

The Phase 1 site plan shows a loading area at the north side of the building, with room for more than one loading space. The addition of buildings in Phase 2 should include a loading space for the library.

Forecast Parking Demand

The proposed parking supply was also considered against forecast parking demand. Note that this process did not consider the fire station, as it has a separate parking supply that exceeds the By-law requirement. That supply was considered sufficient to accommodate demand.

Parking demand forecasts were developed for weekdays and Saturdays, using parking generation rates and time of day profiles from the Institute of Transportation Engineers (ITE) *Parking Generation Manual, 6th Edition*. Relevant land use categories included:

- #495 Recreational Community Center
  to represent the rec centre in Phase 1 and the aquatic centre in Phase 2
- #565 Day Care Center
  to represent the childcare centre in Phase 1
- #465 Ice Skating Rink
  to represent the ice rinks in Phase 2
- #590 Library
  to represent the library in Phase 2

Note that there were several complications that called for additional data:

- In Phase 1, the facilities at SWRC were less-developed than the typical facilities included in the ITE Recreation Center category. MORR conducted parking observations at Winakwa Community Center in Windsor Park, a centre with facilities like those proposed for SWRC Phase 1. Observations were conducted on Friday, October 18th and Saturday, October 19th, 2024. The parking observations were used to develop parking demand rates and time of day profiles to use for Phase 1 parking demand forecasts. The peak parking demand rates were 3.29 vehicles per 1,000 ft^2 floor area on weekdays, and 3.62 vehicles per 1,000 ft^2 floor area on Saturdays, compared to ITE rates averaging 1.79 vehicles per 1,000 ft^2 floor area on weekdays, and 1.8 vehicles per 1,000 ft^2 floor area on Saturdays.

- In Phase 2, the rec centre and aquatic centre forecasts used peak parking demand data from Cindy Klassen Rec Complex and the YMCA/YWCA South Branch, collected by MORR on another project. The peak parking demand rate was 4 vehicles per 1,000 ft^2 floor area, compared to an ITE rate of 1.8 vehicles per 1,000 ft^2 floor area. Time of day profiles were taken from the ITE data.
- In Phase 2, the ice rink forecasts used peak parking demand data from the Dakota Community Centre, collected by MORR on another project. The peak demand rate was 76 vehicles per rink, compared to an ITE average rate of 46 vehicles per rink. Time of day profiles were taken from the ITE data.

The use of time-of-day profiles allowed for maximum demand times and magnitudes to be identified, with consideration for how different land uses have their parking demand peak at different times of day.

Figure 12 shows the forecast weekday parking demand for Phase 1, against the supply included in the Phase 1 site plan. Note that the observations at Winakwa Community Centre only covered the period from 4:00 PM to 9:00 PM, so the time-of-day profile was assumed for the earlier part of the day. Figure 13 shows a similar plot of forecast Saturday parking demand for Phase 1.

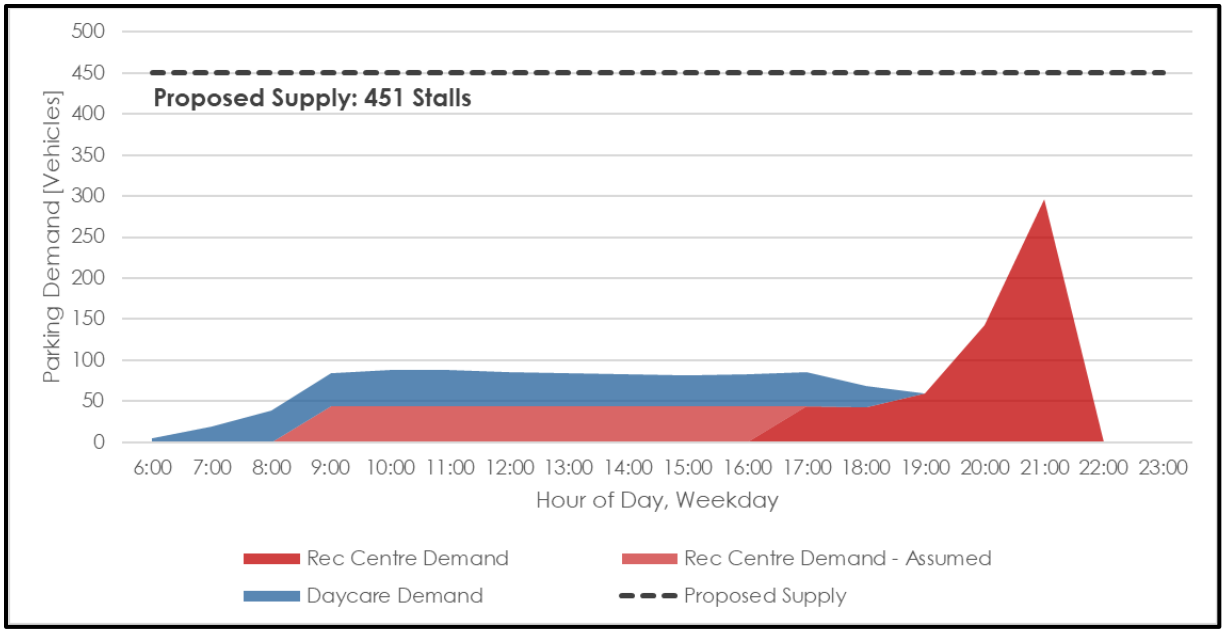


FIGURE 12: FORECAST WEEKDAY PARKING DEMAND – PHASE 1

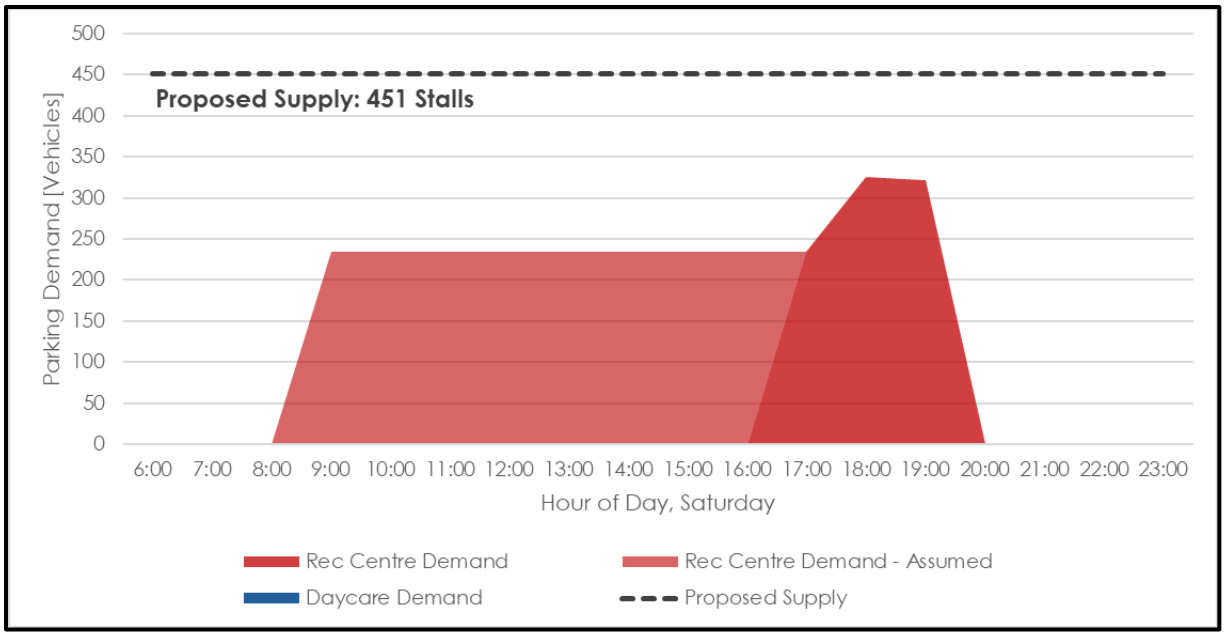


FIGURE 13: FORECAST SATURDAY PARKING DEMAND – PHASE 1

Phase 1 parking demand is forecast to peak at 326 vehicles, from 6:00 to 7:00 PM on Saturdays. Weekday demand is forecast to peak at 296 vehicles, from 7:00 to 8:00 PM on weekdays. Note that Phase 1 rec centre demand is forecast to be relatively low throughout the day, when demand from the childcare centre is at its highest.

Both forecast peaks are well below the 451 stalls included on the Phase 1 site plan. While the proposed parking supply is less than the By-law minimum requirement, it likely exceeds the peak demand for parking in Phase 1. A smaller parking supply is projected to be viable for Phase 1. If a smaller supply was considered, it should include at least 384 stalls, such that the forecast peak demand would use 85% of the available supply—a typical measure for a "practically full" parking lot.

Figure 14 and Figure 15 show the forecast parking demand for Phase 2 weekday and Saturday conditions, respectively. Note that the ITE time of day profiles did not cover the entirety of the day, so demand at some times of day was estimated according to MORR's judgement.

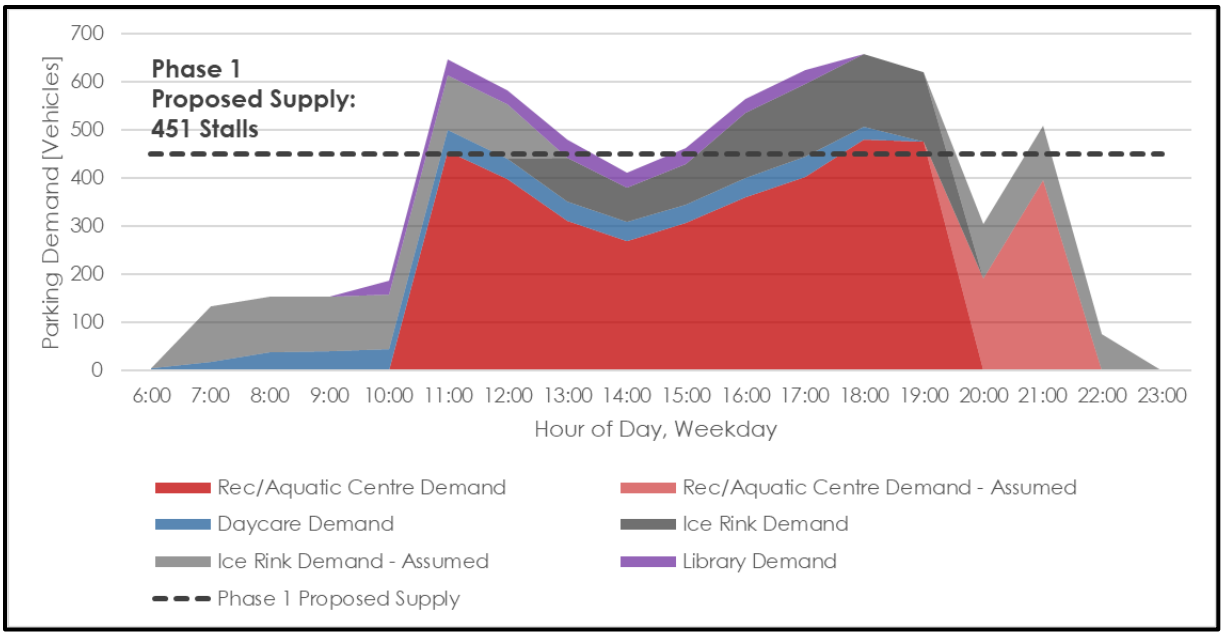


FIGURE 14: FORECAST WEEKDAY PARKING DEMAND – PHASE 2

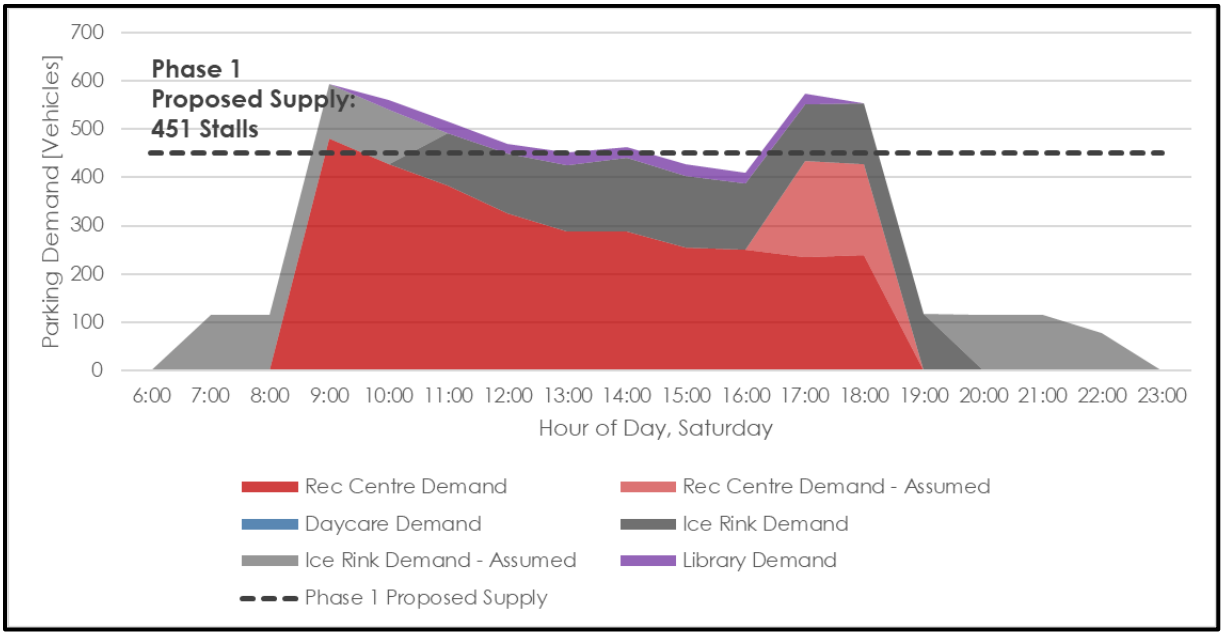


FIGURE 15: FORECAST SATURDAY PARKING DEMAND – PHASE 2

Phase 2 parking demand is forecast to peak at 658 vehicles, from 6:00 to 7:00 PM on weekdays. Saturday demand is forecast to peak at 594 vehicles, from 9:00 to 10:00 AM. This demand exceeds the parking supply shown on the Phase 1 site plan, indicating that development of Phase 2 should likely include a net increase in the parking supply. It is recommended that parking needs for Phase 2 be reassessed when Phase 2 components are added to reflect the actual peak Phase 1 parking demand in the supply calculation.

Parking demand calculations are included in Appendix E.

Pick up and Drop Off ("People Loading")

The By-law does not include requirements for pick-up and drop-off. Provisions for pick-up and drop-off can be based on practical considerations and references to similar facilities in Winnipeg. People loading spaces are typically not provided at libraries, so considerations for pick-up and drop-off were limited to the rec centre/aquatic centre, ice rink, and daycare.

Table 9 shows the pick-up and drop off provisions from other recreation centres in Winnipeg.

TABLE 9: PICK UP AND DROP OFF PROVISIONS AT REFERENCE SITES

Location	Building Floor Area [ft^2]	Spaces for Pick-Up and Drop-Off
Winakwa Community Centre	20,700	0
Cindy Klassen Recreation Complex	87,700	5
YMCA/YWCA South Branch	42,500	4
Dakota Community Centre	121,000 (footprint)	9
Pan-Am Pool	101,000 (footprint)	8

The Winakwa Community Centre has no formal pick-up and drop-off spaces, but the other recreation centres had at least four and up to nine loading spaces, with the larger centres having a greater number of loading spaces. The five loading spaces at the Cindy Klassen Recreation Complex are likely a good starting point for pick-up and drop-off at the SWRC, as the two facilities have similar floor areas (87,700 ft^2 vs 90,000 ft^2).

For daycares, MORR typically recommends that pick-up and drop-off spaces be provided at a ratio of one space per four children. With 176 childcare spaces, 44 pick-up and drop-off spaces should be available. Daycare pick-up and drop-off involves walking the child into and out of the building, and as such the loading spaces can be configured like short-term parking stalls, rather than a configuration like a loading loop where the driver remains in the vehicle and the dwell time is much shorter. It is unnecessary to have full-time dedicated stalls for daycare loading, as activity is concentrated around morning drop-off and afternoon pick-up times on weekdays. Daycare loading could occur from the SWRC parking stalls. Some stalls near the doors could be designated for daycare loading at peak times on weekdays, typically 7:00 to 9:00 AM and 3:00 to 5:00 PM.

The SWRC site plan includes 27 lay-by style loading spaces in two areas—exceeding a prudent minimum supply for the Phase 1 rec centre, and likely sufficient for the facilities in Phase 2. The current high supply of loading spaces at the east end of the site will likely draw drop-off demand from the two schools immediately to the east, as a convenient alternative for parents arriving from the southwest. Daycare loading is expected to also make use of the lay-by spaces though they could also be accommodated in parking stalls. If the lot is found to be well-utilized and stalls are hard to come by, stalls could be designated for daycare use at pick-up and drop-off times.

There is a left-side loading area shown on the loading loop. The left-side of the vehicle will be along an island, so anyone walking from the vehicle to the building will have to cross the drive aisle, either walking around the vehicle they just exited, or exiting directly into the drive aisle. This is a non-ideal configuration. With the surplus of loading spaces provided (see the previous Section), this left-side loading area can be removed, bringing the total supply to 24 spaces, with 19 of them on the south side of the building, and 5 on the west side.

Summary

Table 10 shows MORR's recommendations related to the Phase 1 site plan parking and loading provisions.

TABLE 10: PHASE 1 PARKING AND LOADING SUMMARY

Item	Phase 1 Site Plan Provisions	MORR Recommendations
Parking	451 Stalls 23 EV Stalls 15 Accessible Stalls 31 Bike Parking Spaces	Total parking supply can be reduced to as few as 384 stalls. Add curb ramps for the accessible stalls at the north edge of the north lot. Identify an area to accommodate up to the By-law requirement of 77 spaces but install additional bike racks only if required by actual demand. Locate bike racks near building doors and in visible areas.
Goods Loading	2 Loading Spaces	No changes are required. The loading area on the north side of the building has room for enough loading spaces.
Pick up and Drop off	27 Lay-by Loading Spaces	Have daycare load from the 19 lay-by loading spaces along the south side of the building. If necessary, designate additional daycare loading with 25 spaces in the regular parking area, reserved for daycare use from 7:00 to 9:00 AM and 3:00 to 5:00 PM.

4.3.2 Circulation

MORR reviewed the site plan relative to pedestrian, cyclist, and vehicle circulation. Generally, proposed asphalt multi-use paths and concrete sidewalks provide relatively direct connections between the rec centre building, parking areas, and city paths and sidewalks. The SWRC site is well-connected (by paths and sidewalks) with the multi-use path along Bison Drive, concrete multi-use paths on Ruth Crossing and Joe Keeper Way, and with Pembina Trails Collegiate and Bison Run school. Walking trips can be made between the schools and SWRC without crossing vehicle drive aisles.

In terms of vehicle circulation, the site plan includes a main internal drive aisle that connects to Joe Keeper Way and to Ruth Crossing, while providing access to the parking lots and loading areas on site. The alignment includes several changes in direction to limit the length of straight segments, which will help to control speeds. The alignment could be convenient for short-cutting between the east on Joe Keeper Way

and the west on Bison Drive—the route is shorter than Joe Keeper Way to Ruth Crossing to Bison Drive, and it avoids the school speed zone on Frontier Trail. Raised pedestrian crossings are included in the site plan to reduce the shortcutting appeal. Raised crossings will make bus and fire truck access to the site somewhat less comfortable, although a bus or truck entering from Ruth Crossing would only need to navigate through two raised crossings to reach the loading area.

Snow storage could be in the southwest corner of the north lot and the south end of the south lot. Windrows should be kept below typical driver eye height (1.0 metres) in areas around intersections on the main internal road, as noted on Figure 16. Figure 16 also shows a summary of MORR's recommendations for snow storage and low snow areas. Note that the "low snow areas" should generally extend 10 to 15 m (two car lengths) along the internal road, and 2 m perpendicular to the road. This will provide motorists with sightlines to crossing pedestrians and other vehicles that may cross their path.

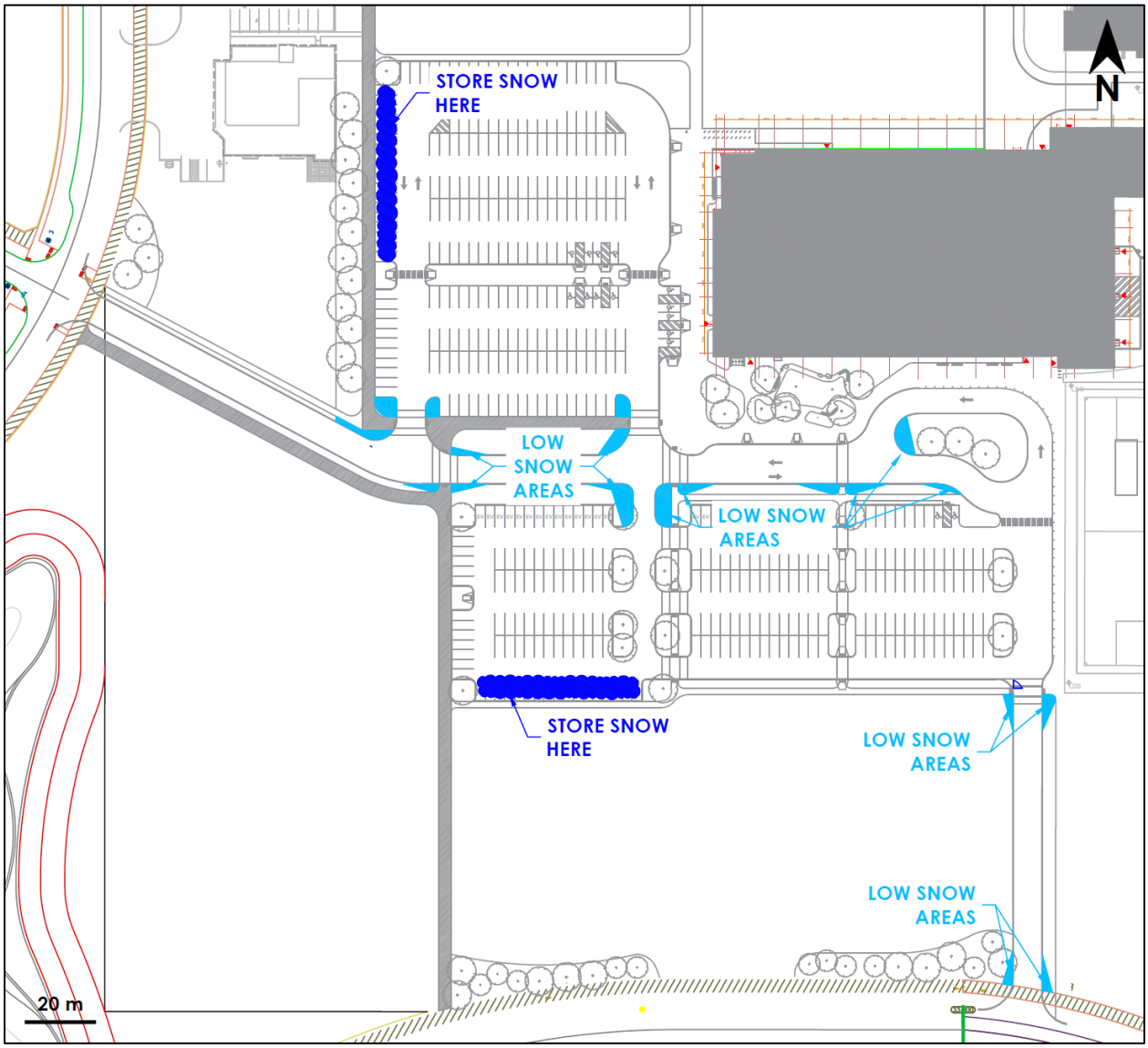


FIGURE 16: SNOW STORAGE RECOMMENDATIONS

4.3.3 Swept Path Checks

Passenger and large vehicle access geometry was evaluated using swept-path simulations. Simulations were completed for four scenarios:

1. Garbage trucks accessing the loading area along the north side of the rec centre building.
2. Aerial ladder fire trucks accessing the building doors.
3. School buses accessing the loading loop on the south side of the building.
4. Passenger vehicles at street approaches.

Figure 17 through Figure 19 show the results of the large vehicle simulations.

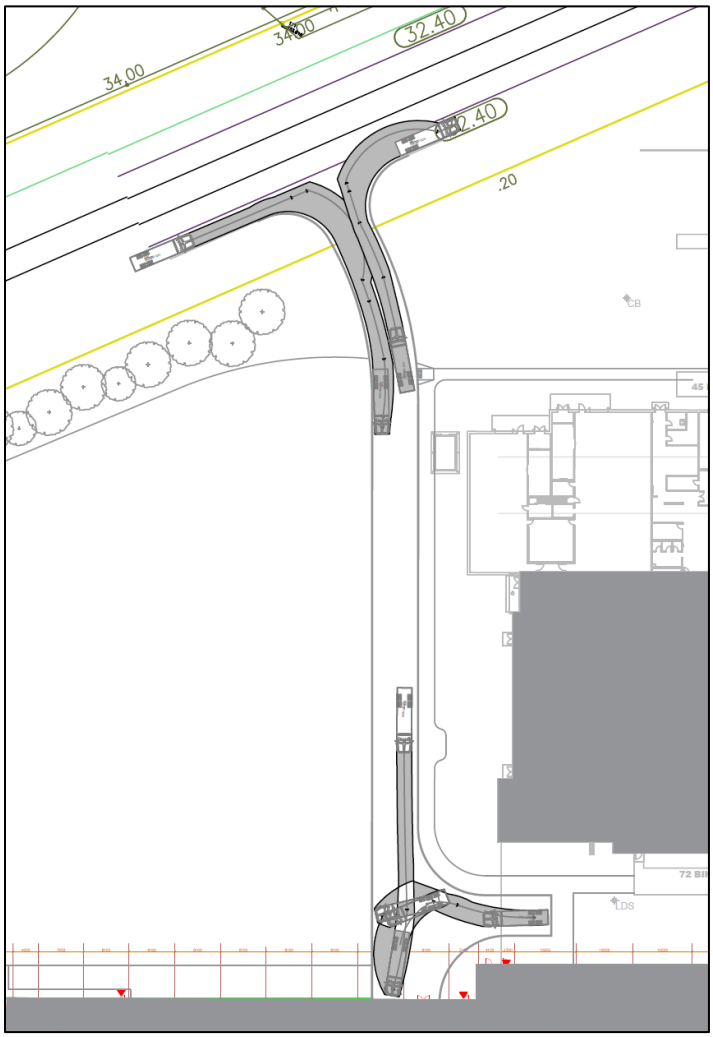


FIGURE 17: GARBAGE TRUCK AUTOTURN

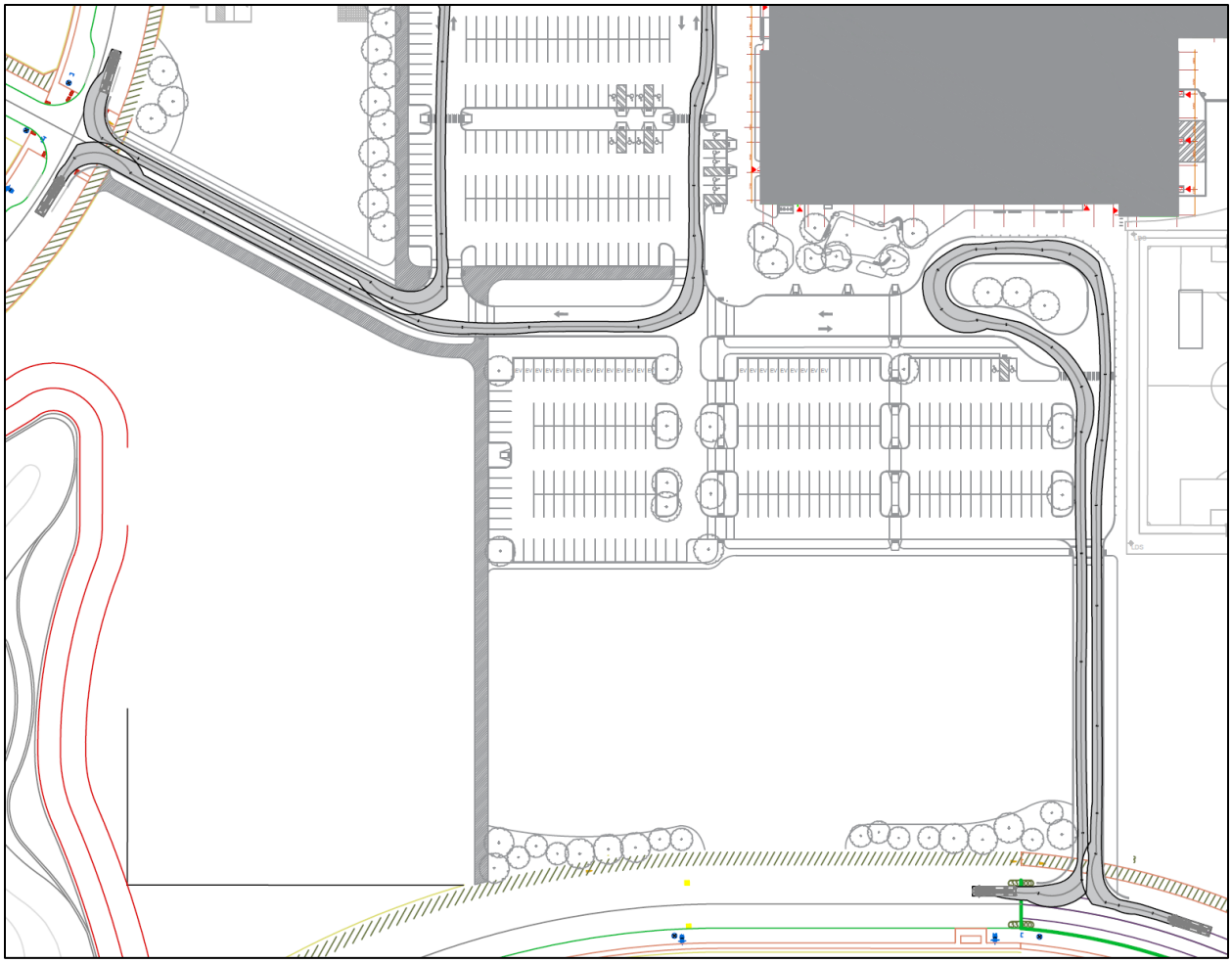


FIGURE 18: AERIAL FIRE TRUCK AUTOTURN

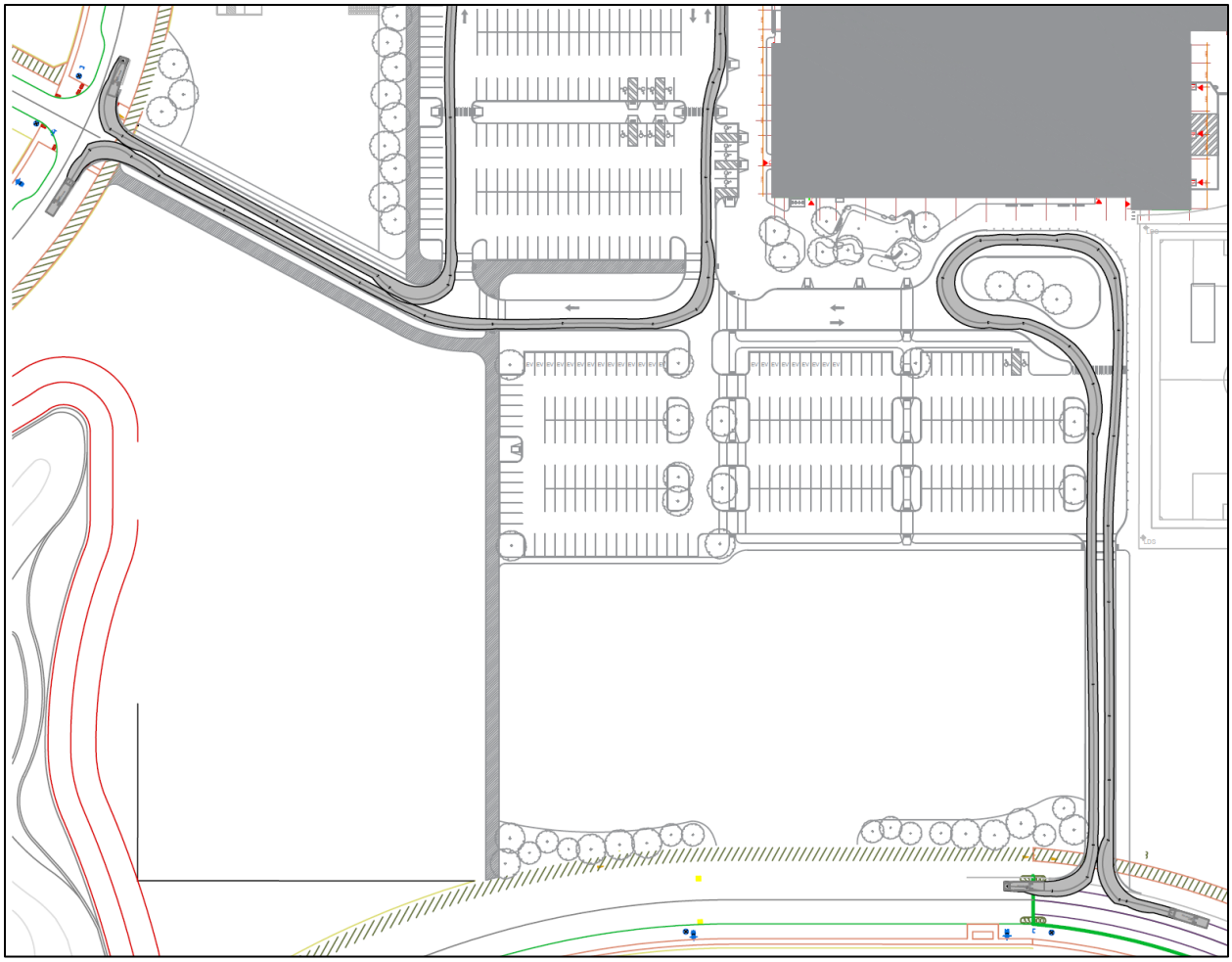


FIGURE 19: SCHOOL BUS AUTOTURN

AutoTURN runs (Figure 20, Figure 21, and Figure 22) were completed to show bi-directional passenger vehicle movements at the SWRC street approaches. Proposed width and radii are shown for the proposed approaches along with the separation distance to confirm that there is approximately 1m spacing between the tire tracking and curb, and between the passenger vehicles for bidirectional movements.

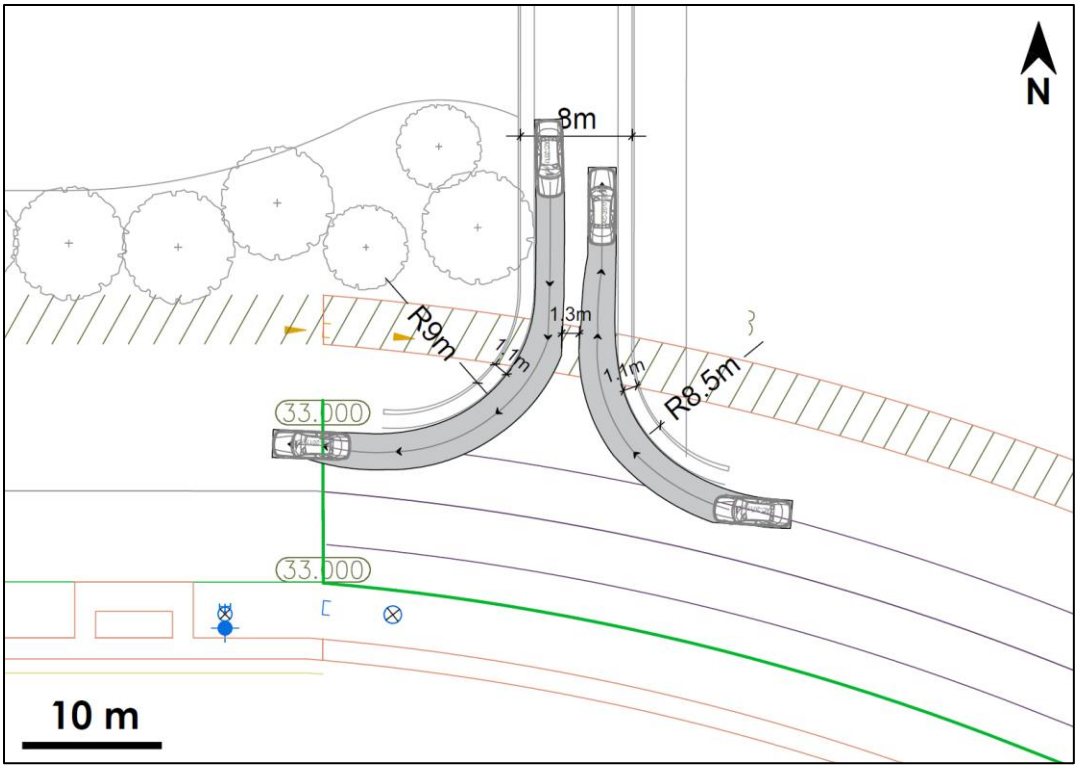


FIGURE 20: PASSENGER VEHICLE AUTOTURN AT SOUTH APPROACH

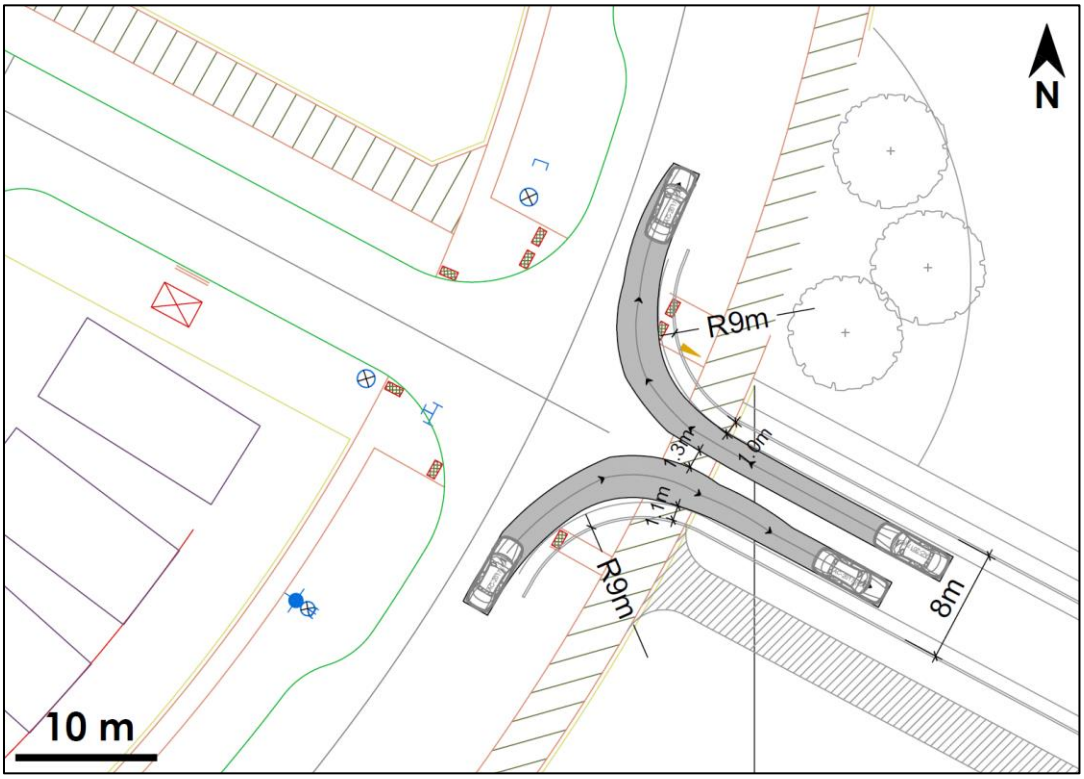


FIGURE 21: PASSENGER VEHICLE AUTOTURN ON WEST APPROACH

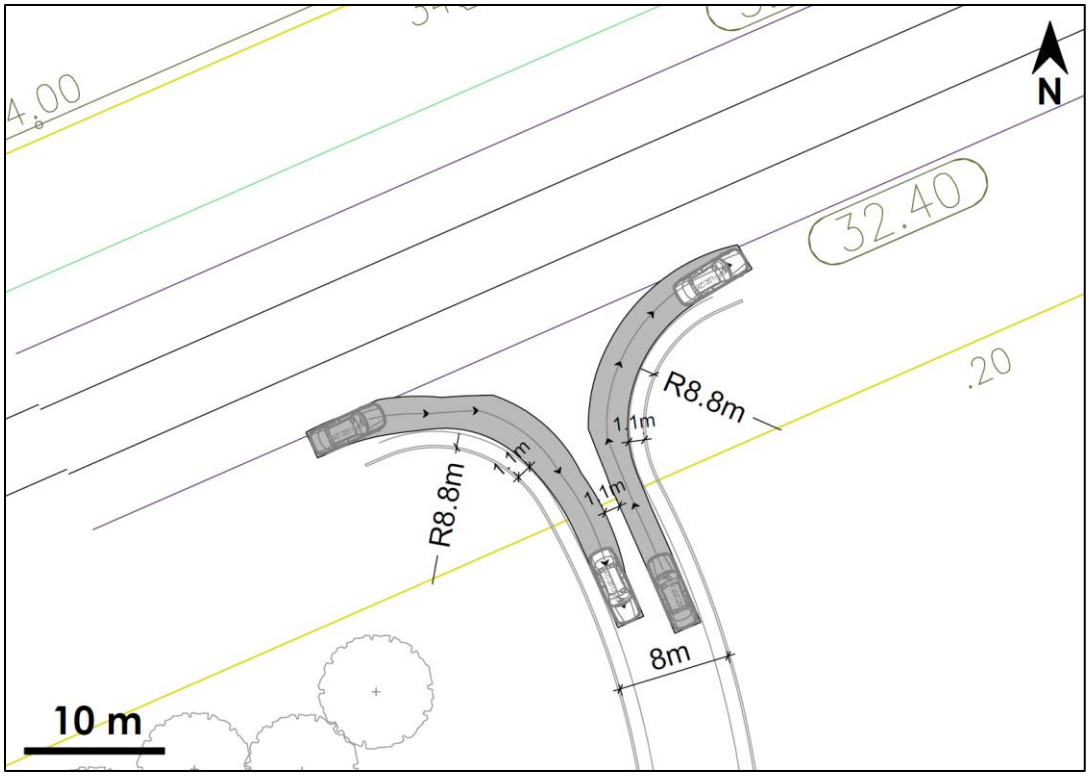


FIGURE 22: PASSENGER VEHICLE AUTOTURN ON NORTH APPROACH

5 CONCLUSIONS AND RECOMMENDATIONS

This traffic and parking study was prepared according to plans showing development of the South Winnipeg Recreation Campus (SWRC) in two phases:

PHASE 1

- A 90,000 ft^2 recreation centre containing three gymnasiums, multi-purpose rooms, an indoor walking track, and fitness space, in a two-storey building.
- A 20,000 ft^2 childcare facility accommodating 48 infants, 128 preschool kids, and 53 staff.
- An outdoor spray pad
- A fire station

PHASE 2

- Library (14,500 ft^2)
- Aquatics Centre (30,000 ft^2)
- Two indoor hockey rinks (83,000 ft^2)
- Outdoor amenities such as outdoor basketball court, tennis court, pickleball courts, a skate/BMX area, and four soccer fields

Where Phase 1 is planned for implementation in 2027, and there is no timeline for Phase 2. The study considered Bison Drive in its current condition as of 2024—a two-lane cross-section, terminating at Frontier Trail. The study did not consider conditions with a four-lane Bison Drive or conditions with the road extended to Waverley Street.

MORR offers the following conclusions:

- In Phase 1, the SWRC site is forecast to generate 347 vehicle trips in the AM peak hour, and 402 vehicle trips in the PM peak hour. Weekday trip generation is forecast at approximately 3,500 trips per day.
    - After the addition of Phase 2, peak hour vehicle trip generation is forecast to increase to 422 vehicle trips in the AM peak hour and 623 vehicle trips in the PM peak hour, with 5,800 daily vehicle trips.
- Growth in background traffic (traffic unrelated to SWRC) is forecast to create a need for traffic signals at the intersection of Bison Drive and Frontier Trail, at a 2033 horizon. The addition of traffic from SWRC does not meaningfully affect this projection.
- Traffic signals are forecast to be required at the intersection of Bison Drive and Ruth Crossing at a 2041 horizon, with SWRC fully built out with Phases 1 and 2.

  - Peak hour traffic operations analyses found that the existing intersection would fail to provide good performance on the northbound approach, but the addition of a median on Bison Drive allowing two-stage left-turns would address the performance issues. The addition of traffic signal control would also address the northbound approach performance issues. For both modified configurations, the intersection was assumed to include a westbound left-turn lane.

- In both post-development scenarios, both SWRC access intersections provided good traffic operations performance with simple minor-road stop-controlled intersections with single lane approaches.

- Path connections to Bison Drive and Ruth Crossing meet the criteria to be candidate sites for pedestrian crossing control. Appropriate forms of crossing control for each location are noted below in the recommendations. The need for pedestrian crossing control on Joe Keeper Way depends on future transit, future development, and future traffic volumes.

- The parking supply shown on the Phase 1 site plan (451 stalls) is less than the By-law requirement, but more than sufficient for the expected demand. Other recreation centres in Winnipeg also have supplies below the By-law, and the supply on the SWRC site plan is more generous than the supplies at those centres. The supply could be reduced to 384 stalls and still adequately accommodate the forecast Phase 1 parking demand, with some room to spare (forecast 85% utilization at peak).

  - The site plan shows 15 accessible stalls, equal to the By-law requirement for Phase 1.

  - The supply and location of EV stalls seems appropriate though it is recommended that the two isolated stalls in the southwest corner of the lot be moved into one of the other two groupings to concentrate the supporting infrastructure.

  - The site plan shows 31 bike parking spaces, but the By-law requires 77. The By-law requirement has not been vetted by an evaluation of projected demand.

  - In Phase 2, peak parking demand is forecast to increase to 658 spaces at full build-out, which is close to the 600 stalls currently proposed in Phase 2.

- The site plan loading supply includes sufficient provisions vs the By-law requirements (concerned with goods loading), and an abundance of pick-up and drop-off spaces, well exceeding the provisions for similar rec centres in Winnipeg. The location of the spaces at the east edge of the site may result in their use by parents picking up children at the schools immediately to the east. Daycare loading will likely also make use of stalls in the parking lot.

- The site plan includes a well-connected path and sidewalk network. Raised crossing will also help to prevent vehicle traffic short-cutting through the site.

Based on the above conclusions, MORR recommends the following for SWRC Phase 1:

- Pursue City implementation of a controlled pedestrian crossing on Bison Drive at the path alignment approximately 160 m east of Ruth Crossing. The crossing should be controlled by rectangular rapid flashing beacons (RRFBs).
- Pursue City implementation of a controlled pedestrian crossing at the SWRC site access on Ruth Crossing, at Rangeview Way. The crossing should have sign control. Whether the crossing is on the north or south side or constructed as a raised or at road level can be determined by the City later based on observed need.
- At the SWRC access to Joe Keeper Way, monitor pedestrian crossing demand, the status of Transit service, and traffic volumes for post-development consideration of pedestrian crossing control.
- Have the daycare load from the loading spaces on the south side of the building, and from stalls in the south parking lot.
- Identify an area to accommodate up to the By-law requirement of 77 bike parking spaces but install additional bike racks beyond the 31 spaces proposed only if required by actual demand.
- Implement the snow storage recommendations as shown in Figure 16.

At this point, Phase 2 is anticipated to generate a parking demand exceeding 600 parking stalls at full build-out; however, this supply projection should be reassessed when Phase 2 additions are proposed to reflect actual Phase 1 peak parking demand at that time.

APPENDIX A:

Level of Service Definitions

Appendix

A

LEVEL OF SERVICE

Level of Service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers.

Highway Capacity Manual Level of Service (HCM LOS)

The 2010 Highway Capacity Manual (HCM) identifies control delay as the primary service measure with LOS determined from the control delay estimate. Control delay is defined as the component of delay that results when a traffic control device causes a lane group to reduce speed or stop; it is measured against the uncontrolled condition.

Six Levels of Service are defined (briefly described below) with LOS A representing the best operating conditions, and LOS F the worst. It should be noted that there is often significant variability in the amount of delay experienced by individual drivers. The LOS criteria for stop-controlled intersections are different than that used for a signalized intersection, this is primarily because of the different driver expectance at these two environments.

LOS A: This level of service describes the highest quality of traffic flow and is referred to as free flow. The approach appears open, turning movements are easily made and drivers have freedom of operation. Control delay is less than 10 seconds/vehicle.

LOS B: This level of service is referred to as a stable flow. Drivers feel somewhat restricted and occasionally may have to wait to complete minor movement. Control delay is 10 – 15 seconds/vehicle for unsignalized intersections and 10 – 20 seconds/vehicle for signalized intersections.

LOS C: At this level, the operation is stable. Drivers feel more restricted and may have to wait, with queues developing for short periods. Control delay is 15 – 25 seconds/vehicle at unsignalized intersection and 20 – 35 seconds/vehicle at signalized intersections.

LOS D: At this level, traffic is approaching unstable flow. The motorist experiences increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period, but there are enough gaps to lower demand to permit occasional clearance of developing queues and prevent excessive back-ups. Control delay is 25 – 35 seconds/vehicle at unsignalized intersections and 35 – 55 seconds/vehicle at signalized intersections.

LOS E: At this level, maximum capacity occurs. Long queues of vehicles exist and delays to vehicles may extend. Control delay is 35 – 50 seconds/vehicle at unsignalized intersections and 55 – 80 seconds/vehicle at signalized intersections.

LOS F: At this level of service, the intersection has failed. Capacity of the intersection has been exceeded. Control delay exceeds 50 seconds/vehicle at unsignalized intersections and exceeds 80 seconds/vehicle at signalized intersections.

Appendix

B

APPENDIX B:

Traffic Data and Calculations

Turning Movement Count: Bison Drive at Frontier Trail
Wednesday, March 13, 2024

TOTAL

		Southbound						Westbound						Northbound						Eastbound							
Date	Time	U Turns	Left Turns	Straight Through	Right Turns	EB Crosswalk Crossings	WB Crosswalk Crossings	U Turns	Left Turns	Straight Through	Right Turns	NB Crosswalk Crossings	SB Crosswalk Crossings	U Turns	Left Turns	Straight Through	Right Turns	EB Crosswalk Crossings	WB Crosswalk Crossings	U Turns	Left Turns	Straight Through	Right Turns	NB Crosswalk Crossings	SB Crosswalk Crossings	15 Min	Hour
2024-03-13	0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
	6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57
	6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	99
	7:00	0	0	6	2	0	0	0	0	0	0	0	0	0	2	6	0	0	0	0	4	0	5	0	1	25	197
	7:15	0	0	9	1	0	1	0	0	0	0	0	0	0	4	4	0	0	1	0	5	0	9	0	1	32	382
	7:30	1	0	9	5	0	0	0	0	0	0	0	0	0	4	5	0	0	0	0	10	0	8	0	1	42	652
	7:45	0	0	22	9	0	0	0	0	0	0	0	0	0	10	15	0	0	1	0	15	0	27	0	7	98	731
	8:00	1	0	48	4	0	0	0	0	0	0	0	0	0	23	31	0	0	2	0	16	0	87	0	29	210	674
	8:15	3	0	61	12	0	2	0	0	0	0	0	0	6	38	53	0	0	0	0	13	0	116	1	26	302	512
	8:30	0	0	16	7	0	0	0	0	0	0	0	0	0	31	29	0	0	0	0	6	0	32	2	6	121	243
	8:45	0	0	7	3	0	0	0	0	0	0	0	0	0	10	5	0	0	0	0	8	0	8	0	3	41	144
	9:00	0	0	7	6	0	0	0	0	0	0	0	0	0	10	4	0	0	0	0	11	0	10	0	2	48	130
	9:15	0	0	8	7	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	6	0	7	0	0	33	116
	9:30	0	0	6	6	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	5	0	2	0	0	22	103
	9:45	0	0	0	2	0	0	0	0	0	0	0	0	0	6	2	0	0	0	0	7	0	10	0	0	27	111
	10:00	0	0	5	2	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	8	0	9	0	0	34	107
	10:15	1	0	1	1	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	8	0	5	0	1	20	109
	10:30	0	0	3	4	0	0	0	0	0	0	0	0	0	7	4	0	0	0	0	8	0	4	0	2	30	120
	10:45	0	0	3	6	0	1	0	0	0	0	0	0	0	3	5	0	0	2	0	0	0	6	1	1	23	125
	11:00	0	0	7	1	0	0	0	0	0	0	0	0	0	7	8	0	0	0	0	5	0	8	2	0	36	138
	11:15	0	0	2	0	3	0	0	0	0	0	0	0	0	8	6	0	0	0	0	4	0	11	3	0	31	148
	11:30	3	0	5	3	0	0	0	0	0	0	0	0	0	5	3	0	0	0	0	9	0	7	0	0	35	162
	11:45	0	0	8	0	0	0	0	0	0	0	0	0	1	11	2	0	0	3	0	7	0	7	0	3	36	165
	12:00	0	0	5	5	1	0	0	0	0	0	0	0	0	12	9	0	0	4	0	7	0	8	5	0	46	154
	12:15	0	0	6	8	0	0	0	0	0	0	0	0	0	10	9	0	0	0	0	2	0	10	1	0	45	141
	12:30	0	0	10	5	0	0	0	0	0	0	0	0	0	8	5	0	0	0	0	5	0	5	1	0	38	127
	12:45	0	0	5	2	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	5	0	9	0	2	25	113
	13:00	0	0	8	3	0	2	0	0	0	0	0	0	0	8	4	0	0	0	0	4	0	6	0	3	33	109
	13:15	1	0	5	4	0	0	0	0	0	0	0	0	0	2	4	0	0	2	0	6	0	9	0	1	31	107
	13:30	0	0	2	4	0	0	0	0	0	0	0	0	0	7	1	0	0	0	0	6	0	4	0	2	24	121
	13:45	0	0	7	1	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	1	0	5	2	0	21	167
	14:00	0	0	4	5	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	8	0	7	0	0	31	235
	14:15	0	0	8	4	0	0	0	0	0	0	0	0	0	11	6	0	0	1	0	5	0	11	4	0	45	357
	14:30	0	0	21	6	0	0	0	0	0	0	0	0	0	12	6	0	0	0	0	4	0	21	2	0	70	395
	14:45	2	0	22	5	0	0	0	0	0	0	0	0	0	13	8	0	0	0	0	7	0	32	1	5	89	474
	15:00	0	0	23	4	0	1	0	0	0	0	0	0	3	50	43	0	0	0	0	3	0	27	34	1	153	485
	15:15	0	0	21	2	0	0	0	0	0	0	0	0	1	14	9	0	0	0	0	7	0	29	4	0	83	411
	15:30	2	0	18	9	6	0	0	0	0	0	0	0	6	47	30	0	0	0	0	12	0	25	28	1	149	384
	15:45	0	0	8	9	0	0	0	0	0	0	0	0	2	40	19	0	1	0	0	3	0	19	13	2	100	277
	16:00	1	0	14	10	0	0	0	0	0	0	0	0	0	17	17	0	0	0	0	9	0	11	4	0	79	239
	16:15	2	0	7	8	0	0	0	0	0	0	0	0	0	11	14	0	0	0	0	2	0	12	0	0	56	235
	16:30	1	0	8	1	0	0	0	0	0	0	0	0	0	14	3	0	0	0	0	6	0	9	4	0	42	253
	16:45	0	0	13	13	0	1	0	0	0	0	0	0	0	10	4	0	0	0	0	10	0	12	1	0	62	284
	17:00	0	0	9	11	0	0	0	0	0	0	0	0	0	18	11	0	0	1	0	12	0	14	2	0	75	286
	17:15	1	0	9	8	0	0	0	0	0	0	0	0	0	13	12	0	0	0	0	15	0	16	2	2	74	269
	17:30	0	0	18	5	0	2	0	0	0	0	0	0	0	12	13	0	0	0	0	12	0	13	5	0	73	256
	17:45	2	0	12	9	0	0	0	0	0	0	0	0	0	13	7	0	0	1	0	7	0	14	3	0	64	233
	18:00	0	0	10	7	0	0	0	0	0	0	0	0	0	10	10	0	0	0	0	9	0	12	0	0	58	200
	18:15	0	0	12	5	0	0	0	0	0	0	0	0	0	17	6	0	0	0	0	9	0	12	0	0	61	142
	18:30	0	0	8	6	0	0	0	0	0	0	0	0	0	13	6	0	0	0	0	9	0	8	0	0	50	81
	18:45	3	0	4	8	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4	0	8	0	1	31	31
	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AM PEAK HR	7:45	4	0	147	32	0	2	0	0	0	0	0	0	6	102	128	0	0	3	0	50	0	262	3	68	731	
PM PEAK HR	15:00	2	0	70	24	6	1	0	0	0	0	0	0	12	151	101	0	1	0	0	25	0	100	79	4	485	
12 HR		24	0	524	248	10	10	0	0	0	0	0	0	19	591	458	0	5	16	0	344	0	746	125	103	2954	

Turning Movement Count: Bison Drive at Frontier Trail
Wednesday, March 13, 2024

Heavy Vehicles

		Southbound						Westbound						Northbound						Eastbound							
Date	Time	U Turns	Left Turns	Straight Through	Right Turns	EB Bicycles in Crosswalk	WB Bicycles in Crosswalk	U Turns	Left Turns	Straight Through	Right Turns	NB Bicycles in Crosswalk	SB Bicycles in Crosswalk	U Turns	Left Turns	Straight Through	Right Turns	EB Bicycles in Crosswalk	WB Bicycles in Crosswalk	U Turns	Left Turns	Straight Through	Right Turns	NB Bicycles in Crosswalk	SB Bicycles in Crosswalk	15 Min	Hour
03-13-2024	0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	6:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	9
	7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
	7:30	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	5	18
	7:45	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	3	13
	8:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	4	13
	8:15	0	0	2	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	1	0	1	6	9
	8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	8:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	3	3
	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	9:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	9:45	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	2
	10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	4
	11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	8
	11:45	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	8
	12:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
	12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	4	6
	12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	3
	12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	13:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
	13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
	13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	4
	14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
	14:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	8
	14:30	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10
	14:45	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2	16
	15:00	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	3	15
	15:15	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	4	14
	15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	3	0	0	0	0	7	13
	15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	6
	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	5
	16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	3	3
	16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
AM PEAK HR	7:45	0	0	3	1	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	4	0	3	13	
PM PEAK HR	15:00	0	0	3	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	4	0	2	1	0	15	
12 HR		0	0	15	2	0	0	0	0	0	0	0	0	0	11	14	0	0	0	0	6	0	14	3	4	62	

AM PEAK HOUR TRAFFIC VOLUMES

Counts

AM PEAK HOUR

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	7:45	6	102	128	0	4	0	147	32	50	0	262				731
Bison & Ruth	2024	7:45										312			134		446
Joe Keeper & Ruth																	0

Heavy Vehicles

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	7:45		2	3				3	1	0		4				13
Bison & Ruth	2024	7:45										4			3		7
Joe Keeper & Ruth																	0

Heavy Vehicle %

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	7:45		2%	2%				2%	3%	0%		2%				2%
Bison & Ruth	2024	7:45										1%			2%		2%
Joe Keeper & Ruth																	

Peak Hour Factors

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	7:45															0.61
Bison & Ruth	2024	7:45															
Joe Keeper & Ruth																	

Conflicting Pedestrians

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	7:45		71						71	2		3				147
Bison & Ruth	2024	7:45															0
Joe Keeper & Ruth																	0

Conflicting Cyclists

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	7:45															0
Bison & Ruth	2024	7:45															0
Joe Keeper & Ruth																	0

Adjustments

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	7:45		3	2				3	3			3				14
Bison & Ruth	2024	7:45										3			6		9
Joe Keeper & Ruth																	0

2024 Background Traffic Volumes

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	7:45		105	130	0		0	150	35	50	0	265	0	0	0	735
Bison & Ruth	2024	7:45		0	0	0		0	0	0	0	315	0	0	140	0	455
Joe Keeper & Ruth	2024																0

AM PEAK HOUR TRAFFIC VOLUMES

Stantec 2041 Post-Development Volumes

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041			382	453				291	127	98		520				1871
Bison & Ruth	2041			48		111						507	37	121	388		1212
Joe Keeper & Ruth				101	10	1		2	2	82	27	218	68	2	347	0	860

Notes:
- Bison & Frontier not included in Stantec memo, west leg volumes balanced to Ruth Cross with N/S split from MORR count, NBT/SBT estimated from WSP 2041 PD vs NBL/SBR

WSP 2041 Background Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041						30		9	5	47			28	7	126
Bison & Ruth	2041										47			37		84
Joe Keeper & Ruth																0

Notes:
- Stantec included WSP 2041 background volumes in their 2041 PD Volumes
- WSP 2041 background volumes include Bison extension from Waverley to Kenaston
- Stantec PD volumes include trips from SWRC

WSP 2041 Background Volumes - Bison extended to Frontier, not to Waverley

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		14						23	29		23				89
Bison & Ruth	2041										47			37		84
Joe Keeper & Ruth																0

Notes:
- EBT/WBT at Frontier re-assigned based on split at Waverley in WSP Report Figure 6.4
- Assume volume to/from Bison East 50/50 south via Frontier vs north via Frontier

Stantec Development Generated Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		368	453	0		0	291	104	69	0	497	0	0	0	1782
Bison & Ruth	2041		48	0	111		0	0	0	0	460	37	121	351	0	1128
Joe Keeper & Ruth	2041		101	10	1		2	2	82	27	218	68	2	347	0	860

Notes:
- Need to account for school and Bison Run Phase 1 development traffic in counts
- Need to remove SWRC volumes from Stantec DG volumes to allow for revised SWRC projections to be added

Stantec SWRC Volumes (Estimated)

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		15						24	13		8				60
Bison & Ruth	2041		10		21							18	39			88
Joe Keeper & Ruth	2041										11			6		17

Notes:
- Stantec SWRC is Zone 9 (see Stantec Figure 3)
- Stantec Zone 9 AM 73 in, 38 out, PM 68 in, 77 out (see Stantec Table 2)
- Stantec distribution on Stantec Figure 4, assume all trips thru Bison & Ruth except trips to/from Bridgwater Centre South, Kenaston South, Waverley South, Lee South

Stantec 2041 BG (2041 PD less SWRC)

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		367	453	0		0	291	103	85	0	512	0	0	0	1811
Bison & Ruth	2041		38	0	90		0	0	0	0	507	19	82	388	0	1124
Joe Keeper & Ruth	2041		101	10	1		2	2	82	27	207	68	2	341	0	843

AM PEAK HOUR TRAFFIC VOLUMES

Stantec WW School Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		219	165				259				342				985
Bison & Ruth	2041										342			219		561
Joe Keeper & Ruth	2041															0

Notes:
- Estimate for use in comparing 2041 PD projections with 2024 count, nothing assigned to Joe Keeper Way
- Schools may not be at full occupancy, but also higher mode split/lower internal capture than assumed in Stantec projections--appropriate to use Stantec numbers at full strength
- Stantec WW schools are Zone 8 (see Stantec Figure 3)
- Stantec Zone 8 AM 796 in, 509 out, PM 164 in, 178 out (see Stantec Table 2)
- Stantec distribution from Stantec Appendix B for Zone 8, assume 15% to/from Bison East routes 50/50 N via NTR, S via Lee until Bison extended to Waverley

Reference: MORR WW School Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		179	269				440				293				1181
Bison & Ruth	2041										293			179		472
Joe Keeper & Ruth	2041															0

Notes:
- Trip gen from MORR TIS Table 13
- Distribution from MORR TIS Table 14

Stantec Zone 6 at 33%

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		15	4				2				7				28
Bison & Ruth	2041										7			15		22
Joe Keeper & Ruth	2041															0

Notes:
- Estimate for use in comparing 2041 PD projections with 2024 count, nothing assigned to Joe Keeper Way
- Stantec Zone 8 AM 50 in, 116 out, PM 132 in, 89 out (see Stantec Table 2)
- Stantec distribution on Stantec Figure 4, assume all Bison East, 2/3 of Waverley N goes S via Lee

2024 BG Reference: WW School @ 60% + Zone 6 @ 33% + BG

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		153	103	0		0	157	12	15	0	224	0	0	0	664
Bison & Ruth	2041		0	0	0		0	0	0	0	236	0	0	165	0	401
Joe Keeper & Ruth	2041															0

Notes:
- School at 60% trip generation based on school division reported 60% enrollment as of April 2024
- 2041 BG (from WSP with Bison to Waverley) at 50% to represent 2024 conditions

Difference: Counts less 2024 BG Reference

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		-48	27	0		0	-7	23	35	0	41	0	0	0	71
Bison & Ruth	2041		0	0	0		0	0	0	0	79	0	0	-25	0	54
Joe Keeper & Ruth	2041															0

2041 BG Adjusted for Difference Between Counts and 2024 BG Reference

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		178	327				378	292	377		299				1851
Bison & Ruth	2041		38	0	90		0	0	0	0	586	19	82	388	0	1203
Joe Keeper & Ruth	2041		101	10	1		2	2	82	27	207	68	2	341	0	843
Ruth & SWRC	2041		5	113				96	5	15		15				249
Joe Keeper & Ruth	2041										210			343		553

Notes:
- 2041 BG volumes adjusted up based on difference, but not adjusted down--2041 BG volumes with Bison to Waverley seemed low, no adjust down to allow for future Bison Growth
- Stantec 2041 doesn't have Bison & Frontier, balance to Bison & Ruth, N/S turn split based on WSP 2041 directional split
- Bison & Frontier estimate NBT & SBT with growth factor from turns (2041 vs 2024) applied to 2024 NB/SB thrus

AM PEAK HOUR TRAFFIC VOLUMES

2024-2041 BG Growth Rates

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		3.15%	5.58%				5.59%	13.29%	12.62%		0.71%				
Bison & Ruth	2041		23.86%		30.30%						3.72%	18.91%	29.59%	6.18%		
Joe Keeper & Ruth	2041															

2027 BG - Estimate Linear from 2024 and 2041

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2027		118	165	0	0	0	190	80	108	0	271	0	0	0	932
Bison & Ruth	2027		7	0	16	0	0	0	0	0	363	3	14	184	0	587
Joe Keeper & Ruth	2027		18	2	0	0	0	0	14	5	37	12	0	60	0	148
Ruth & SWRC	2027		5	18				12	5	5		5				50
Joe Keeper & Ruth	2027										37			60		97

Development Generated Traffic - Phase 1

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier			3	0	0		0	0	41	28	0	2	0	0	0	74
Bison & Ruth			35	0	30		0	0	0	0	0	52	44	0	0	161
Joe Keeper & Ruth			0	0	0		0	0	14	21	21	0	0	14	0	70
Ruth & SWRC			0	0	21		96	0	0	0	0	0	14	0	65	196
Joe Keeper & SWRC			0	0	0		47	0	14	21	0	0	0	0	70	152

Phase 1 Post-Development Traffic Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2027		121	165	0		0	190	121	136	0	273	0	0	0	1006
Bison & Ruth	2027		42	0	46		0	0	0	0	363	55	58	184	0	748
Joe Keeper & Ruth	2027		18	2	0		0	0	28	26	58	12	0	74	0	218
Ruth & SWRC			5	18	21		96	12	5	5	0	5	14	0	65	246
Joe Keeper & SWRC			0	0	0		47	0	14	21	37	0	0	60	70	249

Development Generated Traffic - Phase 2

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier			4	0	0		0	0	49	33	0	2	0	0	0	88
Bison & Ruth			41	0	35		0	0	0	0	0	61	53	0	0	190
Joe Keeper & Ruth			0	0	0		0	0	17	25	25	0	0	17	0	84
Ruth & SWRC			0	0	25		114	0	0	0	0	0	17	0	76	232
Joe Keeper & SWRC			0	0	0		55	0	17	25	0	0	0	0	81	178

Phase 2 Post-Development Traffic Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		182	327	0		0	378	341	410	0	301	0	0	0	1939
Bison & Ruth	2041		79	0	125		0	0	0	0	586	80	135	388	0	1393
Joe Keeper & Ruth	2041		101	10	1		2	2	99	52	232	68	2	358	0	927
Ruth & SWRC			5	113	25		114	96	5	15	0	15	17	0	76	481
Joe Keeper & SWRC			0	0	0		55	0	17	25	210	0	0	343	81	731

PM PEAK HOUR TRAFFIC VOLUMES

Counts

PM PEAK HOUR

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00	12	151	101		2		70	24	25		100				473
Bison & Ruth	2024	15:00										125			175		300
Joe Keeper & Ruth																	0

Heavy Vehicles

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00		2	4				3	0	4		2				15
Bison & Ruth	2024	15:00										6			2		8
Joe Keeper & Ruth																	0

Heavy Vehicle %

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00		1%	4%				4%	0%	16%		2%				3%
Bison & Ruth	2024	15:00										5%			1%		3%
Joe Keeper & Ruth																	

Peak Hour Factors

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00															0.77
Bison & Ruth	2024	15:00															
Joe Keeper & Ruth																	

Conflicting Pedestrians

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00		83						83	7		1				174
Bison & Ruth	2024	15:00															0
Joe Keeper & Ruth																	0

Conflicting Cyclists

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00															0
Bison & Ruth	2024	15:00															0
Joe Keeper & Ruth																	0

Adjustments

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00		-1	-1					1							-1
Bison & Ruth	2024	15:00										0			0		0
Joe Keeper & Ruth																	0

2024 Background Traffic Volumes

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00		150	100	0		0	70	25	25	0	100	0	0	0	470
Bison & Ruth	2024	15:00		0	0	0		0	0	0	0	125	0	0	175	0	300
Joe Keeper & Ruth	2024																0

PM PEAK HOUR TRAFFIC VOLUMES

Stantec 2041 Post-Development Volumes

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024	15:00		387	287				161	65	93		370				1363
Bison & Ruth	2024	15:00		60		82						381	118	171	281		1093
Joe Keeper & Ruth				158	8	1		2	34	26	4	90	213	6	47	1	590

Notes:
- Bison & Frontier not included in Stantec memo, west leg volumes balanced to Ruth Cross with N/S split from MORR count, NBT/SBT estimated from WSP 2041 PD vs NBL/SBR

WSP 2041 Background Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041						2		8	5	48			25	38	126
Bison & Ruth	2041										50			33		83
Joe Keeper & Ruth																0

Notes:
- Stantec included WSP 2041 background volumes in their 2041 PD Volumes
- WSP 2041 background volumes include Bison extension from Waverley to Kenaston
- Stantec PD volumes include trips from SWRC

WSP 2041 Background Volumes - Bison extended to Frontier, not to Waverley

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		12						21	29		24				86
Bison & Ruth	2041										50			33		83
Joe Keeper & Ruth																0

Notes:
- EBT/WBT at Frontier re-assigned based on split at Waverley in WSP Report Figure 6.4
- Assume volume to/from Bison East goes south on Frontier to/from Lee

Stantec Development Generated Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		375	287	0		0	161	44	64	0	346	0	0	0	1277
Bison & Ruth	2041		60	0	82		0	0	0	0	331	118	171	248	0	1010
Joe Keeper & Ruth	2041		158	8	1		2	34	26	4	90	213	6	47	1	590

Notes:
- Need to account for school and Bison Run Phase 1 development traffic in counts
- Need to remove SWRC volumes from Stantec DG volumes to allow for revised SWRC projections to be added

Stantec SWRC Volumes (Estimated)

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		14						22	25		15				76
Bison & Ruth	2041		19		40							17	36			112
Joe Keeper & Ruth	2041										10			12		22

Notes:
- Stantec SWRC is Zone 9 (see Stantec Figure 3)
- Stantec Zone 9 AM 73 in, 38 out, PM 68 in, 77 out (see Stantec Table 2)
- Stantec distribution on Stantec Figure 4, assume all trips thru Bison & Ruth except trips to/from Bridgwater Centre South, Kenaston South, Waverley South, Lee South

Stantec 2041 BG (2041 PD less SWRC)

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		373	287	0		0	161	43	68	0	355	0	0	0	1287
Bison & Ruth	2041		41	0	42		0	0	0	0	381	101	135	281	0	981
Joe Keeper & Ruth	2041		158	8	1		2	34	26	4	80	213	6	35	1	568

PM PEAK HOUR TRAFFIC VOLUMES

Stantec WW School Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		77	58				53				71				259
Bison & Ruth	2041										71			77		148
Joe Keeper & Ruth	2041															0

Notes:
- Estimate for use in comparing 2041 PD projections with 2024 count, nothing assigned to Joe Keeper Way
- Schools may not be at full occupancy, but also higher mode split/lower internal capture than assumed in Stantec projections--appropriate to use Stantec numbers at full strength
- Stantec WW schools are Zone 8 (see Stantec Figure 3)
- Stantec Zone 8 AM 796 in, 509 out, PM 164 in, 178 out (see Stantec Table 2)
- Stantec distribution on Stantec Figure 4, assume 20% to/from Bison East routes 50/50 N via NTR, S via Lee until Bison extended to Waverley

Reference: MORR WW School Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		163	245				148				99				655
Bison & Ruth	2041										99			163		262
Joe Keeper & Ruth	2041															0

Notes:
- Trip gen from MORR TIS Table 13
- Distribution from MORR TIS Table 14

Stantec Zone 6 at 33%

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		12	3				5				17				37
Bison & Ruth	2041										17			12		29
Joe Keeper & Ruth	2041															0

Notes:
- Estimate for use in comparing 2041 PD projections with 2024 count, nothing assigned to Joe Keeper Way
- Stantec Zone 8 AM 50 in, 116 out, PM 132 in, 89 out (see Stantec Table 2)
- Stantec distribution on Stantec Figure 4, assume all Bison East, 2/3 of Waverley N goes S via Lee

2024 BG Reference: WW School @ 60% + Zone 6 @ 33% + BG

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		64	38	0		0	37	11	15	0	72	0	0	0	237
Bison & Ruth	2041		0	0	0		0	0	0	0	85	0	0	75	0	160
Joe Keeper & Ruth	2041															0

Notes:
- School at 60% trip generation based on school division reported 60% enrollment as of April 2024
- 2041 BG (from WSP with Bison to Waverley) at 50% to represent 2024 conditions

Difference: Counts less 2024 BG Reference

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		86	62	0		0	33	14	10	0	28	0	0	0	233
Bison & Ruth	2041		0	0	0		0	0	0	0	40	0	0	100	0	140
Joe Keeper & Ruth	2041															0

2041 BG Adjusted for Difference Between Counts and 2024 BG Reference

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		188	326				228	328	253		210				1533
Bison & Ruth	2041		41	0	42		0	0	0	0	421	101	135	381	0	1121
Joe Keeper & Ruth	2041		158	8	1		2	34	26	4	80	213	6	35	1	568
Ruth & SWRC	2041		15	78				221	15	5		5				339
Joe Keeper & Ruth	2041										83			42		125

Notes:
- 2041 BG volumes adjusted up based on difference, but not adjusted down--2041 BG volumes with Bison to Waverley seemed low, no adjust down to allow for future Bison Growth
- Stantec 2041 doesn't have Bison & Frontier, balance to Bison & Ruth, N/S turn split based on WSP 2041 directional split
- Bison & Frontier estimate NBT & SBT with growth factor from turns (2041 vs 2024) applied to 2024 NB/SB thrus

PM PEAK HOUR TRAFFIC VOLUMES

2024-2041 BG Growth Rates

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		1.34%	7.20%				7.19%	16.35%	14.59%		4.46%				
Bison & Ruth	2041		24.41%		24.59%						7.40%	31.19%	33.45%	4.68%		
Joe Keeper & Ruth	2041															

2027 BG - Estimate Linear from 2024 and 2041

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2027		157	140	0	0	0	98	78	65	0	119	0	0	0	657
Bison & Ruth	2027		7	0	7	0	0	0	0	0	177	18	24	211	0	444
Joe Keeper & Ruth	2027		28	1	0	0	0	6	5	1	14	38	1	6	0	100
Ruth & SWRC	2027		5	9				37	5	5		5				66
Joe Keeper & Ruth	2027										14			7		21

Development Generated Traffic - Phase 1

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier			3	0	0		0	0	38	42	0	3	0	0	0	86
Bison & Ruth			53	0	45		0	0	0	0	0	48	41	0	0	187
Joe Keeper & Ruth			0	0	0		0	0	21	19	19	0	0	21	0	80
Ruth & SWRC			0	0	19		89	0	0	0	0	0	21	0	98	227
Joe Keeper & SWRC			0	0	0		71	0	21	19	0	0	0	0	64	175

Phase 1 Post-Development Traffic Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2027		160	140	0		0	98	116	107	0	122	0	0	0	743
Bison & Ruth	2027		60	0	52		0	0	0	0	177	66	65	211	0	631
Joe Keeper & Ruth	2027		28	1	0		0	6	26	20	33	38	1	27	0	180
Ruth & SWRC			5	9	19		89	37	5	5	0	5	21	0	98	293
Joe Keeper & SWRC			0	0	0		71	0	21	19	14	0	0	7	64	196

Development Generated Traffic - Phase 2

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier			4	0	0		0	0	56	60	0	5	0	0	0	125
Bison & Ruth			75	0	65		0	0	0	0	0	70	60	0	0	270
Joe Keeper & Ruth			0	0	0		0	0	30	28	28	0	0	30	0	116
Ruth & SWRC			0	0	28		130	0	0	0	0	0	30	0	140	328
Joe Keeper & SWRC			0	0	0		101	0	30	28	0	0	0	0	94	253

Phase 2 Post-Development Traffic Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2041		192	326	0		0	228	384	313	0	215	0	0	0	1658
Bison & Ruth	2041		116	0	107		0	0	0	0	421	171	195	381	0	1391
Joe Keeper & Ruth	2041		158	8	1		2	34	56	32	108	213	6	65	1	684
Ruth & SWRC			15	78	28		130	221	15	5	0	5	30	0	140	667
Joe Keeper & SWRC			0	0	0		101	0	30	28	83	0	0	42	94	378

DAILY TRAFFIC VOLUMES

12 Hour Counts — 24 HOUR

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier	2024		19	591	458				524	248	344		746				2930	1600	0	2300	1900
Bison & Ruth	2024											1090			839		1929	0	1900	0	1900
Joe Keeper & Ruth																	0	0	0	0	0

Heavy Vehicles

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier	2024			11	14				15	2	6		14				62	0	0	100	0
Bison & Ruth	2024											20			13		33	0	0	0	0
Joe Keeper & Ruth																	0	0	0	0	0

Heavy Vehicle %

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024			2%	3%				3%	1%	2%		2%				2%
Bison & Ruth	2024											2%			2%		2%
Joe Keeper & Ruth																	

Conflicting Pedestrians

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024		21	228			20			228	20		21	21		20	579
Bison & Ruth	2024																0
Joe Keeper & Ruth																	0

Conflicting Cyclists

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL
Bison & Frontier	2024																0
Bison & Ruth	2024																0
Joe Keeper & Ruth																	0

Expansion to 24 Hour

Intersection	Year	Factor	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier	2024	1.33	25	786	609	0	0	0	697	330	458	0	992	0	0	0	3897	2100	0	3100	2600
Bison & Ruth	2024	1.33	0	0	0	0	0	0	0	0	0	1450	0	0	1116	0	2566	0	2600	0	2600
Joe Keeper & Ruth		1.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2024 Background Traffic Volumes

Intersection	Year	Time Start	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier	2024		25	786	609	0	0	0	697	330	458	0	992	0	0	0	3897	2100	0	3100	2600
Bison & Ruth	2024		0	0	0	0	0	0	0	0	0	1450	0	0	1116	0	2566	0	2600	0	2600
Joe Keeper & Ruth			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

DAILY TRAFFIC VOLUMES

2041 BG Adjusted for Difference Between Counts and 2024 BG Reference

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier	2041		1647	2939				2727	2790	2835		2291				15229	11300	0	9600	9600
Bison & Ruth	2041		356	0	594		0	0	0	0	4532	540	977	3461	0	10460	0	9600	2500	8900
Joe Keeper & Ruth	2041		1166	81	9		18	162	486	140	1292	1265	36	1692	5	6352	900	3100	2700	6000
Ruth & SWRC	2041		90	860				1427	90	90		90				2647	2500	0	2500	400
Joe Keeper & Ruth	2041										1319			1733		3052	0	3100	0	3100

2027 BG - Estimate Linear from 2024 and 2041

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier	2027		963	1068	0	0	0	1008	553	606	0	1365	0	0	0	5563	3200	0	4400	3500
Bison & Ruth	2027		49	0	81	0	0	0	0	0	1890	74	133	1383	0	3610	0	3500	300	3400
Joe Keeper & Ruth	2027		161	11	0	0	0	21	67	21	179	175	4	231	0	870	100	400	400	800
Ruth & SWRC	2027		35	95				172	35	35		35				407	300	0	300	100
Joe Keeper & Ruth	2027										179			235		414	0	400	0	400

Development Generated Traffic - Phase 1

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier			26	0	0		0	0	350	350	0	26	0	0	0	752	700	0	100	800
Bison & Ruth			438	0	376		0	0	0	0	0	438	376	0	0	1628	0	800	1600	900
Joe Keeper & Ruth			0	0	0		0	0	175	175	175	0	0	175	0	700	400	400	0	700
Ruth & SWRC			0	0	175		814	0	0	0	0	0	175	0	814	1978	1600	2000	400	0
Joe Keeper & SWRC			0	0	0		587	0	175	175	0	0	0	0	587	1524	1500	1200	0	400

Phase 1 Post-Development Traffic Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier	2027		989	1068	0	0	0	1008	903	956	0	1391	0	0	0	6315	3900	0	4500	4200
Bison & Ruth	2027		487	0	457	0	0	0	0	0	1890	512	509	1383	0	5238	0	4200	2000	4300
Joe Keeper & Ruth	2027		161	11	0	0	0	21	242	196	354	175	4	406	0	1570	500	800	400	1500
Ruth & SWRC			35	95	175		814	172	35	35	0	35	175	0	814	2385	2000	2000	700	100
Joe Keeper & SWRC			0	0	0		587	0	175	175	179	0	0	235	587	1938	1500	1600	0	800

Development Generated Traffic - Phase 2

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier			40	0	0		0	0	537	536	0	40	0	0	0	1153	1100	0	100	1200
Bison & Ruth			671	0	576		0	0	0	0	0	671	577	0	0	2495	0	1200	2500	1300
Joe Keeper & Ruth			0	0	0		0	0	268	269	269	0	0	268	0	1074	500	500	0	1100
Ruth & SWRC			0	0	269		1248	0	0	0	0	0	268	0	1247	3032	2500	3000	500	0
Joe Keeper & SWRC			0	0	0		899	0	268	269	0	0	0	0	899	2335	2300	1800	0	500

Phase 2 Post-Development Traffic Volumes

Intersection	Year	Time Start	NBL	NBT	NBR		SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	TOTAL	N	E	S	W
Bison & Frontier	2041		1687	2939	0	0	0	2727	3327	3371	0	2331	0	0	0	16382	12400	0	9700	10700
Bison & Ruth	2041		1027	0	1170	0	0	0	0	0	4532	1211	1554	3461	0	12955	0	10700	5000	10200
Joe Keeper & Ruth	2041		1166	81	9	0	18	162	754	409	1561	1265	36	1960	5	7426	1400	3600	2700	7100
Ruth & SWRC			90	860	269	0	1248	1427	90	90	0	90	268	0	1247	5679	5000	3000	3000	400
Joe Keeper & SWRC			0	0	0	0	899	0	268	269	1319	0	0	1733	899	5387	2300	4900	0	3600

PHASE 1

90 ksf rec centre (3 gyms, multi-purpose rooms, walking track, fitness space)
20 ksf childcare centre (48 babies + 128 pre-K, 53 staff)
Outdoor spray pad
Fire station

PHASE 2

14.5 ksf library
30 ksf acquatic centre
83 ksf indoor ice (2x hockey rinks)
Outdoor basketball court, tennis court, pickleball courts, skate/BMX park, 4x soccer fields

TRIP GENERATION

Weekday AM/PM focus, Saturday peak hour for reference

Type	Quantity	IV	ITE LU	AM Rate	AM % In	PM Rate	PM % In	Day Rate	Day % In	Sat Rate	Sat % In	AM Trips	AM In	AM Out	PM Trips	PM In	PM Out	Day Trips	Day In	Day Out	Sat Trips	Sat In	Sat Out
Rec Centre	90	ksf	495	1.91	0.66	2.50	0.47	28.82	0.50	1.07	0.54	172	114	58	225	106	119	2594	1297	1297	96	52	44
Childcare Centre	176	ildcare spa	565	0.78	0.53	0.79	0.47	4.09	0.50	0.11	0.63	137	73	64	139	65	74	720	360	360	19	12	7
Outdoor Spray Pad	Assume included in Rec Centre																						
Fire Station	25	parking spaces		1.50	0.50	1.50	0.50	7.50	0.50	1.50	0.50	38	19	19	38	19	19	188	94	94	38	19	19
											TOTAL	347	206	141	402	190	212	3502	1751	1751	153	83	70

Note: Time periods are adjacent street peak hour (except Saturday)
ITE 495 weekday generator rates are within 0.05 of adjacent street peak hour rates, use peak hour adj rates
Winakwa CC PM adj street rate is 4.88, nearly double ITE. Winakwa is only 20ksf vs 90ksf SWRC--Winakwa rate applied to ITE would be higher than all points in ITE data set.
Average of Winakwa CC rate and ITE rate would be in the middle of ITE points at 90 ksf--but Phase 1 SWRC basic vs ITE description. Use ITE rate, which is on the lower side.
ITE rate still gives 2.25x total PM trips vs Winakwa
Fire station rate represents shift change, 75% of stalls turn over with a vehicle entering and another exiting during the hour, assume daily 5x PM

Internal Capture

Assume capture between rec centre and childcare centre
% of outbound traffic

AM%	Rec Centre	Childcare Centre
Rec Centre		2%
Childcare C	2%	

AM Trips	Rec Centre	Childcare Centre
Rec Centre		1.16
Childcare C	1.28	

PM%	Rec Centre	Childcare Centre
Rec Centre		5%
Childcare C	5%	

PM Trips	Rec Centre	Childcare Centre
Rec Centre		5.95
Childcare C	3.7	

Conclusions: Internal capture effect is very small, unless rate is quite high
Don't bother with internal capture

Pass-By Trips

ITE has 1 reference study for LU 565
Assume all primary trips

DIRECTIONAL DISTRIBUTION

Direction	%	AM Trips	AM In	AM Out	PM Trips	PM In	PM Out	Day Trips	Day In	Day Out
North on Frontier	20.0%	69	41	28	80	38	42	700	350	350
South on Frontier	10.0%	35	21	14	40	19	21	350	175	175
West on Bison	25.0%	87	52	35	101	48	53	876	438	438
West on Joe Keeper	20.0%	69	41	28	80	38	42	700	350	350
East on Joe Keeper	25.0%	87	52	35	101	48	53	876	438	438
	100.0%									

PHASE 1

90 ksf rec centre (3 gyms, multi-purpose rooms, walking track, fitness space)
20 ksf childcare centre (48 babies + 128 pre-K, 53 staff)
Outdoor spray pad
Fire station

PHASE 2

14.5 ksf library
30 ksf acquatic centre
83 ksf indoor ice (2x hockey rinks)
Outdoor basketball court, tennis court, pickleball courts, skate/BMX park, 4x soccer fields

TRIP GENERATION

Weekday AM/PM focus, Saturday peak hour for reference

Type	Quantity	IV	ITE LU	AM Rate	AM % In	PM Rate	PM % In	Day Rate	Day % In	Sat Rate	Sat % In	AM Trips	AM In	AM Out	PM Trips	PM In	PM Out	Day Trips	Day In	Day Out	Sat Trips	Sat In	Sat Out
Rec Centre	90	ksf	495	1.91	0.66	2.50	0.47	28.82	0.50	1.07	0.54	172	114	58	225	106	119	2594	1297	1297	96	52	44
Childcare Centre	176	ildcare spa	565	0.78	0.53	0.79	0.47	4.09	0.50	0.11	0.63	137	73	64	139	65	74	720	360	360	19	12	7
Outdoor Spray Pad	Assume included in Rec Centre																						
Fire Station	25	Parking Spaces		1.50	0.50	1.50	0.50	7.50	0.50	1.50	0.50	38	19	19	38	19	19	188	94	94	38	19	19
Library	14.5	ksf	590	0.27	0.71	2.47	0.51	21.81	0.50	3.01	0.53	4	3	1	36	18	18	316	158	158	44	23	21
Acquatic Centre	30	ksf	495	1.91	0.66	2.50	0.47	28.82	0.50	1.07	0.54	57	38	19	75	35	40	865	433	432	32	17	15
Indoor Ice Rink	83	ksf	465	0.17	0.37	1.33	0.55	13.30	0.50	2.63	0.53	14	5	9	110	61	49	1104	552	552	218	116	102
Outdoor Facilities	Assume included in Rec Centre																						
										Total Phase 2		75	46	29	221	114	107	2285	1143	1142	294	156	138
										TOTAL		497	252	170	623	304	319	5787	2894	2893	447	239	208
										% vs Phase 1		143%	122%	121%	155%	160%	150%	165%	165%	165%	292%	288%	297%

Note: Time periods are adjacent street peak hour (except Saturday)
ITE 495 weekday generator rates are within 0.05 of adjacent street peak hour rates, Rec Centre rates averaged from ITE and Winakwa CC
Winakwa CC PM adj street rate is 4.88, nearly double ITE. Winakwa is only 20ksf vs 90ksf SWRC--Winakwa rate applied to ITE would be higher than all points in ITE data set.
Use ITE rate for Rec Centre
Fire station rate represents shift change, 75% of stalls turn over with a vehicle entering and another exiting during the hour, estimate daily as 5x PM
Library rate from counts at existing Transcona Library--ITE small sample, higher rates, use ITE for weekday, adjusted with PM factor Transcona vs ITE
Acquatic Centre rates from ITE 495
Indoor Ice Rink rates from ITE 465--small sample size, only one study for AM, weekday estimate at 10*PM
Dakota CC ~100 trips entering PM

Internal Capture

Assume capture between rec centre, childcare centre, library, ice rink
% of outbound traffic

AM%	Rec Centre	Childcare Centre	Library	Acquatic Centre	Ice Rink
Rec Centre		2%		2%	2%
Childcare C	2%				2%
Library					
Acquatic C	2%				2%
Ice Rink	2%	2%		2%	

PM%	Rec Centre	Childcare Centre	Library	Acquatic Centre	Ice Rink
Rec Centre		2%	2%	2%	2%
Childcare C	2%		2%	2%	2%
Library	2%	2%		2%	2%
Acquatic C	2%	2%	2%		2%
Ice Rink	2%	2%	2%	2%	

Weekday%	Rec Centre	Childcare Centre	Library	Acquatic Centre	Ice Rink
Rec Centre		1%	2%	2%	2%
Childcare C	2%		2%	2%	2%
Library	2%	2%		2%	2%
Acquatic C	2%	2%	2%		2%
Ice Rink	2%	2%	2%	2%	

AM Trips	Rec Centre	Childcare Centre	Library	Acquatic Centre	Ice Rink
Rec Centre	0	1.16	0	1.16	1.16
Childcare C	1.28	0	0	0	1.28
Library	0	0	0	0	0
Acquatic C	0.38	0	0	0	0.38
Ice Rink	0.18	0.18	0	0.18	0

PM Trips	Rec Centre	Childcare Centre	Library	Acquatic Centre	Ice Rink
Rec Centre	0	2.38	2.38	2.38	2.38
Childcare C	1.48	0	1.48	1.48	1.48
Library	0.36	0.36	0	0.36	0.36
Acquatic C	0.8	0.8	0.8	0	0.8
Ice Rink	0.98	0.98	0.98	0.98	0

Weekday T	Rec Centre	Childcare Centre	Library	Acquatic Centre	Ice Rink
Rec Centre	0	12.97	25.94	25.94	25.94
Childcare C	7.2	0	7.2	7.2	7.2
Library	3.16	3.16	0	3.16	3.16
Acquatic C	8.64	8.64	8.64	0	8.64
Ice Rink	11.04	11.04	11.04	11.04	0

Type	Internal AM Trips	AM In	AM Out	PM Trips	PM In	PM Out	Weekday	Weekday In	Weekday Ou	External AM Trips	AM In	AM Out	PM Trips	PM In	PM Out	Weekday	Weekday In	Weekday Out
Rec Centre	5.32	1.84	3.48	13.14	3.62	9.52	120.83	30.04	90.79	166.68	112.16	54.52	211.86	102.38	109.48	2473.17	1266.96	1206.21
Childcare Centre	3.9	1.34	2.56	10.44	4.52	5.92	64.61	35.81	28.8	133.1	71.66	61.44	128.56	60.48	68.08	655.39	324.19	331.2
Outdoor Spray Pad										0	0	0	0	0	0	0	0	0
Fire Station										38	19	19	38	19	19	188	94	94
Library	0	0	0	9.56	5.64	3.92	65.46	52.82	12.64	4	3	1	26.44	12.36	14.08	250.54	105.18	145.36
Acquatic Centre	2.1	1.34	0.76	5.2	5.2	0	81.9	47.34	34.56	54.9	36.66	18.24	69.8	29.8	40	783.1	385.66	397.44
Indoor Ice Rink	3.36	2.82	0.54	5.02	5.02	0	89.1	44.94	44.16	10.64	2.18	8.46	104.98	55.98	49	1014.9	507.06	507.84
Outdoor Facilities										0	0	0	0	0	0	0	0	0
TOTAL	14.68	7.34	7.34	43.36	24	19.36	421.9	210.95	210.95	407.32	244.66	162.66	579.64	280	299.64	5365.1	2683.05	2682.05
Internal %	3%	3%	4%	7%	8%	6%	7%	7%	7%									
									Vs Phase 1	117%	119%	115%	144%	147%	141%	153%	153%	153%

Pass-By Trips

ITE has 1 reference study for LU 565
Assume all primary trips

DIRECTIONAL DISTRIBUTION

Direction	%	AM Trips	AM In	AM Out	PM Trips	PM In	PM Out	Weekday	Weekday In	Weekday Out
North on Frontier	20.0%	81	49	33	116	56	60	1073	537	536
South on Frontier	10.0%	41	24	16	58	28	30	537	268	268
West on Bison	25.0%	102	61	41	145	70	75	1341	671	671
West on Joe Keeper	20.0%	81	49	33	116	56	60	1073	537	536
East on Joe Keeper	25.0%	102	61	41	145	70	75	1341	671	671
	100.0%									

Peak Six Hour Volumes

Estimated from AM and PM peak hour volumes
Expansion factor developed from count at Bison Dr & Frontier Trl

		Reference Lee Blvd & Waverley St	Reference Lee Blvd & Keslar Rd
AM Peak Hr	731	1180	339
PM Peak Hr	473	1636	695
Total	1204	2816	1034
AM Peak 2 Hr	955	2477	592
Mid Peak 2 Hr	292	2113	728
PM Peak 2 Hr	724	3074	1253
Total	1971	7664	2573
AM + PM to 6 Hr	1.637043	2.721591	2.488395

Note:
- Frontier Trail development is largely just the schools as of 2024. Volume pattern reflects school trips. May not represent patterns once residential is built out.
- Review factors from Lee Boulevard area, use those factors for future scenarios.
- 2041 Average factors from Lee & Waverley, Lee & Keslar, factor = 2.60. Bison & Frontier is somewhat higher class than Lee & Keslar, but lower than Waverley & Lee.
- 2027 bias factor to 2024 factor--use 1.80.

Estimate Peak 6 Hour Volumes

2024 Background
AM + PM Peak Hours

ID	Intersection	Time Start	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	7:45	255	230	0	0	220	60	0	0	0	75	0	365	1205
102	Bison & Ruth	7:45	0	0	0	0	0	0	0	315	0	0	440	0	755

Peak 6 Hour Volumes

ID	Intersection	Factor	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	1.637043	417	377	0	0	360	98	0	0	0	123	0	598	1973
102	Bison & Ruth	1.637043	0	0	0	0	0	0	0	516	0	0	720	0	1236

2027 Background
AM + PM Peak Hours

ID	Intersection	Time Start	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	7:45	275	305	0	0	288	158	0	0	0	173	0	390	1589
102	Bison & Ruth	7:45	14	0	23	0	0	0	38	395	0	0	540	21	1031

Peak 6 Hour Volumes

ID	Intersection	Factor	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	1.8	495	549	0	0	518	284	0	0	0	311	0	702	2859
102	Bison & Ruth	1.8	25	0	41	0	0	0	68	711	0	0	972	38	1855

2041 Background
AM + PM Peak Hours

ID	Intersection	Time Start	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	7:45	366	653	0	0	606	620	0	0	0	630	0	509	3384
102	Bison & Ruth	7:45	79	0	132	0	0	0	217	769	0	0	1007	120	2324

Peak 6 Hour Volumes

ID	Intersection	Factor	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	2.6	952	1698	0	0	1576	1612	0	0	0	1638	0	1323	8799
102	Bison & Ruth	2.6	205	0	343	0	0	0	564	1999	0	0	2618	312	6041

2027 Phase 1 Post-Development
AM + PM Peak Hours

ID	Intersection	Time Start	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	7:45	281	305	0	0	288	237	0	0	0	243	0	395	1749
102	Bison & Ruth	7:45	102	0	98	0	0	0	123	395	0	0	540	121	1379

Peak 6 Hour Volumes

ID	Intersection	Factor	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	1.8	506	549	0	0	518	427	0	0	0	437	0	711	3148
102	Bison & Ruth	1.8	184	0	176	0	0	0	221	711	0	0	972	218	2482

2041 Phase 2 Post-Development
AM + PM Peak Hours

ID	Intersection	Time Start	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	7:45	374	653	0	0	606	725	0	0	0	723	0	516	3597
102	Bison & Ruth	7:45	195	0	232	0	0	0	330	769	0	0	1007	251	2784

Peak 6 Hour Volumes

ID	Intersection	Factor	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR	EBL	EBT	EBR	TOTAL
101	Bison & Frontier	2.6	972	1698	0	0	1576	1885	0	0	0	1880	0	1342	9353
102	Bison & Ruth	2.6	507	0	603	0	0	0	858	1999	0	0	2618	653	7238

Appendix

C

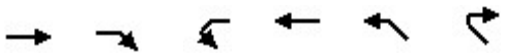
APPENDIX C:

Synchro Traffic Analysis Results

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	50	265	105	130	150	35
Future Volume (vph)	50	265	105	130	150	35
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	82	434	172	213	246	57

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	82	434	172	213	246	57
Volume Left (vph)	82	0	172	0	0	0
Volume Right (vph)	0	434	0	0	0	57
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	5.5	3.2	5.5	5.0	4.7	3.2
Degree Utilization, x	0.13	0.39	0.26	0.29	0.32	0.05
Capacity (veh/h)	595	1114	643	707	744	1121
Control Delay (s)	9.3	8.2	9.2	8.8	9.9	6.4
Approach Delay (s)	8.4		9.0		9.2	
Approach LOS	A		A		A	

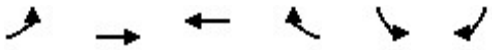
Intersection Summary			
Delay	8.8		
Level of Service	A		
Intersection Capacity Utilization	36.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	315	0	0	140	0	0
Future Volume (Veh/h)	315	0	0	140	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	342	0	0	152	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			342		494	342
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			342		494	342
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1217		535	701

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	342	152	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1217	1700
Volume to Capacity	0.20	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	19.9%	ICU Level of Service	A
Analysis Period (min)	15		



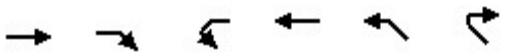
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	0	0	0	0	0	0
Future Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0
Approach Volume (veh/h)		0	0		0	
Crossing Volume (veh/h)		0	0		0	
High Capacity (veh/h)		1385	1385		1385	
High v/c (veh/h)		0.00	0.00		0.00	
Low Capacity (veh/h)		1161	1161		1161	
Low v/c (veh/h)		0.00	0.00		0.00	

Intersection Summary				
Maximum v/c High		0.00		
Maximum v/c Low		0.00		
Intersection Capacity Utilization		0.0%	ICU Level of Service	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	25	100	150	100	70	25
Future Volume (vph)	25	100	150	100	70	25
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	41	164	246	164	115	41

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	41	164	246	164	115	41
Volume Left (vph)	41	0	246	0	0	0
Volume Right (vph)	0	164	0	0	0	41
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	5.3	3.2	5.2	4.7	4.6	3.2
Degree Utilization, x	0.06	0.15	0.36	0.22	0.15	0.04
Capacity (veh/h)	630	1121	677	747	766	1121
Control Delay (s)	8.6	6.7	9.9	7.8	8.3	6.3
Approach Delay (s)	7.1		9.1		7.8	
Approach LOS	A		A		A	

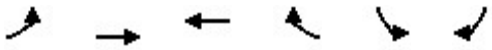
Intersection Summary			
Delay	8.3		
Level of Service	A		
Intersection Capacity Utilization	27.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	125	0	0	175	0	0
Future Volume (Veh/h)	125	0	0	175	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	136	0	0	190	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			136		326	136
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			136		326	136
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1448		668	913

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	136	190	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1448	1700
Volume to Capacity	0.08	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	12.5%	ICU Level of Service	A
Analysis Period (min)	15		



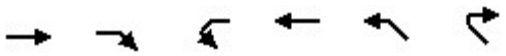
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	0	0	0	0	0	0
Future Volume (veh/h)	0	0	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0
Approach Volume (veh/h)		0	0		0	
Crossing Volume (veh/h)		0	0		0	
High Capacity (veh/h)		1385	1385		1385	
High v/c (veh/h)		0.00	0.00		0.00	
Low Capacity (veh/h)		1161	1161		1161	
Low v/c (veh/h)		0.00	0.00		0.00	

Intersection Summary				
Maximum v/c High		0.00		
Maximum v/c Low		0.00		
Intersection Capacity Utilization		0.0%	ICU Level of Service	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	108	271	118	165	190	80
Future Volume (vph)	108	271	118	165	190	80
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	177	444	193	270	311	131

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	177	444	193	270	311	131
Volume Left (vph)	177	0	193	0	0	0
Volume Right (vph)	0	444	0	0	0	131
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	5.9	3.2	5.9	5.4	5.2	3.2
Degree Utilization, x	0.29	0.39	0.32	0.41	0.45	0.12
Capacity (veh/h)	553	1114	590	644	673	1121
Control Delay (s)	11.3	8.3	10.5	10.9	12.2	6.6
Approach Delay (s)	9.1		10.7		10.6	
Approach LOS	A		B		B	

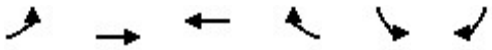
Intersection Summary			
Delay	10.0		
Level of Service	B		
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	363	3	14	184	7	16
Future Volume (Veh/h)	363	3	14	184	7	16
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	395	3	15	200	8	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			398		626	396
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			398		626	396
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	97
cM capacity (veh/h)			1161		442	653

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	398	215	25
Volume Left	0	15	8
Volume Right	3	0	17
cSH	1700	1161	566
Volume to Capacity	0.23	0.01	0.04
Queue Length 95th (m)	0.0	0.3	1.1
Control Delay (s)	0.0	0.7	11.6
Lane LOS		A	B
Approach Delay (s)	0.0	0.7	11.6
Approach LOS			B

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		31.2%	ICU Level of Service A
Analysis Period (min)		15	



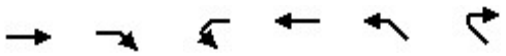
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	5	37	60	0	0	14
Future Volume (veh/h)	5	37	60	0	0	14
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	40	65	0	0	15
Approach Volume (veh/h)		45	65		15	
Crossing Volume (veh/h)		0	5		65	
High Capacity (veh/h)		1385	1379		1316	
High v/c (veh/h)		0.03	0.05		0.01	
Low Capacity (veh/h)		1161	1156		1099	
Low v/c (veh/h)		0.04	0.06		0.01	

Intersection Summary			
Maximum v/c High	0.05		
Maximum v/c Low	0.06		
Intersection Capacity Utilization	16.2%	ICU Level of Service	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	65	119	157	140	98	78
Future Volume (vph)	65	119	157	140	98	78
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	107	195	257	230	161	128

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	107	195	257	230	161	128
Volume Left (vph)	107	0	257	0	0	0
Volume Right (vph)	0	195	0	0	0	128
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	5.6	3.2	5.5	5.0	4.9	3.2
Degree Utilization, x	0.17	0.17	0.39	0.32	0.22	0.11
Capacity (veh/h)	602	1121	642	705	711	1121
Control Delay (s)	9.7	6.9	10.8	9.1	9.2	6.6
Approach Delay (s)	7.9		10.0		8.1	
Approach LOS	A		B		A	

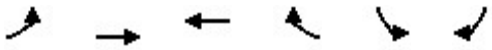
Intersection Summary			
Delay	8.9		
Level of Service	A		
Intersection Capacity Utilization	28.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Traffic Volume (veh/h)	177	18	24	211	7	7
Future Volume (Veh/h)	177	18	24	211	7	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	192	20	26	229	8	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			212		483	202
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			212		483	202
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		98	99
cM capacity (veh/h)			1358		532	839

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	212	255	16
Volume Left	0	26	8
Volume Right	20	0	8
cSH	1700	1358	651
Volume to Capacity	0.12	0.02	0.02
Queue Length 95th (m)	0.0	0.4	0.6
Control Delay (s)	0.0	0.9	10.7
Lane LOS		A	B
Approach Delay (s)	0.0	0.9	10.7
Approach LOS			B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	36.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	1	14	6	0	0	5
Future Volume (veh/h)	1	14	6	0	0	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	15	7	0	0	5
Approach Volume (veh/h)		16	7		5	
Crossing Volume (veh/h)		0	1		7	
High Capacity (veh/h)		1385	1384		1377	
High v/c (veh/h)		0.01	0.01		0.00	
Low Capacity (veh/h)		1161	1160		1154	
Low v/c (veh/h)		0.01	0.01		0.00	

Intersection Summary			
Maximum v/c High	0.01		
Maximum v/c Low	0.01		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	377	299	178	327	378	292
Future Volume (vph)	377	299	178	327	378	292
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	618	490	292	536	620	479

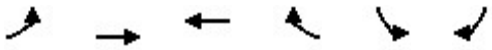
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	618	490	292	536	620	479
Volume Left (vph)	618	0	292	0	0	0
Volume Right (vph)	0	490	0	0	0	479
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	7.2	3.2	8.1	7.6	7.1	3.2
Degree Utilization, x	1.24	0.44	0.66	1.13	1.22	0.43
Capacity (veh/h)	507	1115	434	477	514	1115
Control Delay (s)	146.0	8.6	24.2	108.9	140.5	8.6
Approach Delay (s)	85.3		79.0		83.0	
Approach LOS	F		F		F	

Intersection Summary			
Delay	82.7		
Level of Service	F		
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	586	19	82	388	38	90
Future Volume (Veh/h)	586	19	82	388	38	90
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	637	21	89	422	41	98
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			658		1248	648
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			658		1248	648
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		76	79
cM capacity (veh/h)			930		173	471

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	658	511	139
Volume Left	0	89	41
Volume Right	21	0	98
cSH	1700	930	312
Volume to Capacity	0.39	0.10	0.45
Queue Length 95th (m)	0.0	2.4	16.6
Control Delay (s)	0.0	2.6	25.5
Lane LOS		A	D
Approach Delay (s)	0.0	2.6	25.5
Approach LOS			D

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	27	207	341	0	2	82
Future Volume (veh/h)	27	207	341	0	2	82
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	225	371	0	2	89
Approach Volume (veh/h)		254	371		91	
Crossing Volume (veh/h)		2	29		371	
High Capacity (veh/h)		1382	1354		1034	
High v/c (veh/h)		0.18	0.27		0.09	
Low Capacity (veh/h)		1159	1133		844	
Low v/c (veh/h)		0.22	0.33		0.11	

Intersection Summary				
Maximum v/c High		0.27		
Maximum v/c Low		0.33		
Intersection Capacity Utilization		45.4%	ICU Level of Service	A

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	618	490	292	536	620	479
v/c Ratio	0.96	0.78	0.97	0.53	0.89	0.92
Control Delay	64.1	35.9	74.7	19.7	50.2	53.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.1	35.9	74.7	19.7	50.2	53.0
Queue Length 50th (m)	143.6	82.6	48.9	75.9	130.8	87.7
Queue Length 95th (m)	109.7	62.9	43.3	60.6	100.3	66.7
Internal Link Dist (m)	545.4			517.9	220.3	
Turn Bay Length (m)		15.0	45.0			10.0
Base Capacity (vph)	649	634	301	1074	765	561
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.95	0.77	0.97	0.50	0.81	0.85

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	377	299	178	327	378	292
Future Volume (vph)	377	299	178	327	378	292
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	4.5	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	1.00	1.00	0.80
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1789	1556	1789	1883	1883	1263
Flt Permitted	0.95	1.00	0.10	1.00	1.00	1.00
Satd. Flow (perm)	1789	1556	184	1883	1883	1263
Peak-hour factor, PHF	0.61	0.61	0.61	0.61	0.61	0.61
Adj. Flow (vph)	618	490	292	536	620	479
RTOR Reduction (vph)	0	70	0	0	0	55
Lane Group Flow (vph)	618	420	292	536	620	424
Confl. Peds. (#/hr)	2	3	71			71
Heavy Vehicles (%)	2%	2%	2%	2%	2%	3%
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	41.9	41.9	62.1	62.1	43.1	43.1
Effective Green, g (s)	41.9	41.9	62.1	62.1	43.1	43.1
Actuated g/C Ratio	0.36	0.36	0.54	0.54	0.37	0.37
Clearance Time (s)	6.0	6.0	4.5	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	646	562	299	1008	699	469
v/s Ratio Prot	c0.35		c0.12	0.28	0.33	
v/s Ratio Perm		0.27	c0.40			0.34
v/c Ratio	0.96	0.75	0.98	0.53	0.89	0.90
Uniform Delay, d1	36.2	32.4	33.4	17.5	34.2	34.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.9	5.4	45.2	0.5	13.0	20.5
Delay (s)	61.0	37.8	78.6	18.0	47.2	55.0
Level of Service	E	D	E	B	D	D
Approach Delay (s)	50.8			39.4	50.6	
Approach LOS	D			D	D	

Intersection Summary			
HCM 2000 Control Delay	47.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	116.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	253	210	188	326	228	328
Future Volume (vph)	253	210	188	326	228	328
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	415	344	308	534	374	538

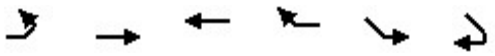
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	415	344	308	534	374	538
Volume Left (vph)	415	0	308	0	0	0
Volume Right (vph)	0	344	0	0	0	538
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	6.8	3.2	7.4	6.9	6.7	3.2
Degree Utilization, x	0.79	0.31	0.63	1.02	0.69	0.48
Capacity (veh/h)	517	1113	475	534	524	1116
Control Delay (s)	30.7	7.6	21.0	69.4	23.3	9.1
Approach Delay (s)	20.3		51.7		14.9	
Approach LOS	C		F		B	

Intersection Summary			
Delay	28.9		
Level of Service	D		
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	421	101	135	381	41	42
Future Volume (Veh/h)	421	101	135	381	41	42
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	458	110	147	414	45	46
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			568		1221	513
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			568		1221	513
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			85		73	92
cM capacity (veh/h)			1004		170	561

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	568	561	91
Volume Left	0	147	45
Volume Right	110	0	46
cSH	1700	1004	262
Volume to Capacity	0.33	0.15	0.35
Queue Length 95th (m)	0.0	3.9	11.3
Control Delay (s)	0.0	3.7	25.9
Lane LOS		A	D
Approach Delay (s)	0.0	3.7	25.9
Approach LOS			D

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SEL	SER
Right Turn Channelized						
Traffic Volume (veh/h)	4	80	35	1	2	26
Future Volume (veh/h)	4	80	35	1	2	26
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	87	38	1	2	28
Approach Volume (veh/h)		91	39		30	
Crossing Volume (veh/h)		2	4		38	
High Capacity (veh/h)		1382	1380		1344	
High v/c (veh/h)		0.07	0.03		0.02	
Low Capacity (veh/h)		1159	1157		1124	
Low v/c (veh/h)		0.08	0.03		0.03	

Intersection Summary				
Maximum v/c High		0.07		
Maximum v/c Low		0.08		
Intersection Capacity Utilization		17.5%	ICU Level of Service	A

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	415	344	308	534	374	538
v/c Ratio	0.79	0.58	0.67	0.56	0.63	0.88
Control Delay	33.6	13.7	18.1	13.7	24.1	28.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.6	13.7	18.1	13.7	24.1	28.4
Queue Length 50th (m)	47.9	15.7	20.8	44.0	39.5	33.0
Queue Length 95th (m)	45.7	15.6	21.3	39.4	38.6	25.7
Internal Link Dist (m)	545.4			517.9	220.3	
Turn Bay Length (m)		15.0	45.0			10.0
Base Capacity (vph)	638	676	458	1099	733	695
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.51	0.67	0.49	0.51	0.77

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	253	210	188	326	228	328
Future Volume (vph)	253	210	188	326	228	328
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	4.5	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	0.88
Flpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1789	1562	1765	1883	1883	1396
Flt Permitted	0.95	1.00	0.33	1.00	1.00	1.00
Satd. Flow (perm)	1789	1562	606	1883	1883	1396
Peak-hour factor, PHF	0.61	0.61	0.61	0.61	0.61	0.61
Adj. Flow (vph)	415	344	308	534	374	538
RTOR Reduction (vph)	0	130	0	0	0	178
Lane Group Flow (vph)	415	214	308	534	374	360
Confl. Peds. (#/hr)	2	3	71			71
Heavy Vehicles (%)	2%	2%	2%	2%	2%	3%
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	18.6	18.6	32.3	32.3	20.1	20.1
Effective Green, g (s)	18.6	18.6	32.3	32.3	20.1	20.1
Actuated g/C Ratio	0.30	0.30	0.51	0.51	0.32	0.32
Clearance Time (s)	6.0	6.0	4.5	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	529	461	453	966	601	446
v/s Ratio Prot	c0.23		c0.08	0.28	0.20	
v/s Ratio Perm		0.14	0.27			c0.26
v/c Ratio	0.78	0.46	0.68	0.55	0.62	0.81
Uniform Delay, d1	20.3	18.1	10.1	10.4	18.2	19.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.5	0.7	4.0	0.7	2.0	10.3
Delay (s)	27.8	18.8	14.1	11.1	20.2	30.0
Level of Service	C	B	B	B	C	C
Approach Delay (s)	23.7			12.2	25.9	
Approach LOS	C			B	C	

Intersection Summary			
HCM 2000 Control Delay	20.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	62.9	Sum of lost time (s)	16.5
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group
Lane Group Flow (vph)
v/c Ratio
Control Delay
Queue Delay
Total Delay
Queue Length 50th (m)
Queue Length 95th (m)
Internal Link Dist (m)
Turn Bay Length (m)
Base Capacity (vph)
Starvation Cap Reductn
Spillback Cap Reductn
Storage Cap Reductn
Reduced v/c Ratio

Intersection Summary

Movement	EBL	EBR	SBL	SBR	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)						
Lane Util. Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0
Turn Type						
Protected Phases						
Permitted Phases						
Actuated Green, G (s)						
Effective Green, g (s)						
Actuated g/C Ratio						
Clearance Time (s)						
Lane Grp Cap (vph)						
v/s Ratio Prot						
v/s Ratio Perm						
v/c Ratio						
Uniform Delay, d1						
Progression Factor						
Incremental Delay, d2						
Delay (s)						
Level of Service						
Approach Delay (s)	0.0		0.0		0.0	
Approach LOS	A		A		A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	3.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	136	273	121	165	190	121
Future Volume (vph)	136	273	121	165	190	121
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	223	448	198	270	311	198

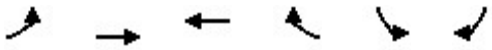
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	223	448	198	270	311	198
Volume Left (vph)	223	0	198	0	0	0
Volume Right (vph)	0	448	0	0	0	198
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	6.0	3.2	6.1	5.6	5.4	3.2
Degree Utilization, x	0.37	0.40	0.34	0.42	0.46	0.18
Capacity (veh/h)	553	1114	570	620	646	1121
Control Delay (s)	12.5	8.3	11.0	11.5	12.9	6.9
Approach Delay (s)	9.7		11.3		10.6	
Approach LOS	A		B		B	

Intersection Summary			
Delay	10.4		
Level of Service	B		
Intersection Capacity Utilization	37.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	363	55	58	184	42	46
Future Volume (Veh/h)	363	55	58	184	42	46
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	395	60	63	200	46	50
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			455		751	425
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			455		751	425
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		87	92
cM capacity (veh/h)			1106		357	629

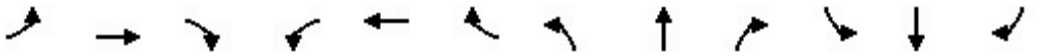
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	455	263	96
Volume Left	0	63	46
Volume Right	60	0	50
cSH	1700	1106	461
Volume to Capacity	0.27	0.06	0.21
Queue Length 95th (m)	0.0	1.4	5.9
Control Delay (s)	0.0	2.4	14.9
Lane LOS		A	B
Approach Delay (s)	0.0	2.4	14.9
Approach LOS			B

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	26	58	74	0	0	28
Future Volume (veh/h)	26	58	74	0	0	28
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	28	63	80	0	0	30
Approach Volume (veh/h)		91	80		30	
Crossing Volume (veh/h)		0	28		80	
High Capacity (veh/h)		1385	1355		1301	
High v/c (veh/h)		0.07	0.06		0.02	
Low Capacity (veh/h)		1161	1134		1085	
Low v/c (veh/h)		0.08	0.07		0.03	

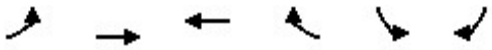
Intersection Summary			
Maximum v/c High	0.07		
Maximum v/c Low	0.08		
Intersection Capacity Utilization	21.2%	ICU Level of Service	A



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	5	14	0	65	5	18	21	96	12	5
Future Volume (Veh/h)	5	0	5	14	0	65	5	18	21	96	12	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	15	0	71	5	20	23	104	13	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	336	276	16	270	268	32	18			43		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	336	276	16	270	268	32	18			43		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	100	98	100	93	100			93		
cM capacity (veh/h)	545	587	1064	643	594	1043	1599			1566		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	10	86	48	122
Volume Left	5	15	5	104
Volume Right	5	71	23	5
cSH	721	941	1599	1566
Volume to Capacity	0.01	0.09	0.00	0.07
Queue Length 95th (m)	0.3	2.3	0.1	1.6
Control Delay (s)	10.1	9.2	0.8	6.4
Lane LOS	B	A	A	A
Approach Delay (s)	10.1	9.2	0.8	6.4
Approach LOS	B	A		

Intersection Summary				
Average Delay	6.4			
Intersection Capacity Utilization	24.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	21	37	60	70	47	14
Future Volume (Veh/h)	21	37	60	70	47	14
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	23	40	65	76	51	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			288			
pX, platoon unblocked						
vC, conflicting volume	141				189	103
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	141				189	103
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				94	98
cM capacity (veh/h)	1442				787	952

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	63	141	66
Volume Left	23	0	51
Volume Right	0	76	15
cSH	1442	1700	819
Volume to Capacity	0.02	0.08	0.08
Queue Length 95th (m)	0.4	0.0	2.0
Control Delay (s)	2.8	0.0	9.8
Lane LOS	A		A
Approach Delay (s)	2.8	0.0	9.8
Approach LOS			A

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	24.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group
Lane Group Flow (vph)
v/c Ratio
Control Delay
Queue Delay
Total Delay
Queue Length 50th (m)
Queue Length 95th (m)
Internal Link Dist (m)
Turn Bay Length (m)
Base Capacity (vph)
Starvation Cap Reductn
Spillback Cap Reductn
Storage Cap Reductn
Reduced v/c Ratio

Intersection Summary

Movement	EBL	EBR	SBL	SBR	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)						
Lane Util. Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0
Turn Type						
Protected Phases						
Permitted Phases						
Actuated Green, G (s)						
Effective Green, g (s)						
Actuated g/C Ratio						
Clearance Time (s)						
Lane Grp Cap (vph)						
v/s Ratio Prot						
v/s Ratio Perm						
v/c Ratio						
Uniform Delay, d1						
Progression Factor						
Incremental Delay, d2						
Delay (s)						
Level of Service						
Approach Delay (s)	0.0		0.0		0.0	
Approach LOS	A		A		A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	3.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	107	122	160	140	98	116
Future Volume (vph)	107	122	160	140	98	116
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	175	200	262	230	161	190

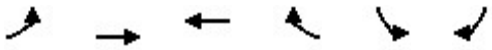
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	175	200	262	230	161	190
Volume Left (vph)	175	0	262	0	0	0
Volume Right (vph)	0	200	0	0	0	190
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	5.6	3.2	5.7	5.2	5.1	3.2
Degree Utilization, x	0.27	0.18	0.42	0.33	0.23	0.17
Capacity (veh/h)	601	1121	613	671	668	1121
Control Delay (s)	10.7	6.9	11.6	9.6	9.7	6.8
Approach Delay (s)	8.7		10.7		8.1	
Approach LOS	A		B		A	

Intersection Summary			
Delay	9.3		
Level of Service	A		
Intersection Capacity Utilization	28.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	177	66	65	211	60	52
Future Volume (Veh/h)	177	66	65	211	60	52
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	192	72	71	229	65	57
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			264		599	228
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			264		599	228
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		85	93
cM capacity (veh/h)			1300		439	811

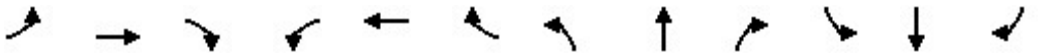
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	264	300	122
Volume Left	0	71	65
Volume Right	72	0	57
cSH	1700	1300	559
Volume to Capacity	0.16	0.05	0.22
Queue Length 95th (m)	0.0	1.3	6.3
Control Delay (s)	0.0	2.3	13.2
Lane LOS		A	B
Approach Delay (s)	0.0	2.3	13.2
Approach LOS			B

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	20	33	27	0	0	26
Future Volume (veh/h)	20	33	27	0	0	26
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	36	29	0	0	28
Approach Volume (veh/h)		58	29		28	
Crossing Volume (veh/h)		0	22		29	
High Capacity (veh/h)		1385	1361		1354	
High v/c (veh/h)		0.04	0.02		0.02	
Low Capacity (veh/h)		1161	1140		1133	
Low v/c (veh/h)		0.05	0.03		0.02	

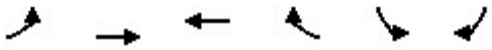
Intersection Summary			
Maximum v/c High	0.04		
Maximum v/c Low	0.05		
Intersection Capacity Utilization	19.5%	ICU Level of Service	A



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	5	21	0	98	5	9	19	89	37	5
Future Volume (Veh/h)	5	0	5	21	0	98	5	9	19	89	37	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	23	0	107	5	10	21	97	40	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	374	278	42	272	270	20	45			31		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	374	278	42	272	270	20	45			31		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	100	96	100	90	100			94		
cM capacity (veh/h)	498	590	1028	644	596	1057	1563			1582		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	10	130	36	142
Volume Left	5	23	5	97
Volume Right	5	107	21	5
cSH	671	949	1563	1582
Volume to Capacity	0.01	0.14	0.00	0.06
Queue Length 95th (m)	0.3	3.6	0.1	1.5
Control Delay (s)	10.4	9.4	1.0	5.2
Lane LOS	B	A	A	A
Approach Delay (s)	10.4	9.4	1.0	5.2
Approach LOS	B	A		

Intersection Summary				
Average Delay	6.6			
Intersection Capacity Utilization	27.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	19	14	7	64	71	21
Future Volume (Veh/h)	19	14	7	64	71	21
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	15	8	70	77	23
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			288			
pX, platoon unblocked						
vC, conflicting volume	78				100	43
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	78				100	43
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	98
cM capacity (veh/h)	1520				886	1027

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	36	78	100
Volume Left	21	0	77
Volume Right	0	70	23
cSH	1520	1700	915
Volume to Capacity	0.01	0.05	0.11
Queue Length 95th (m)	0.3	0.0	2.8
Control Delay (s)	4.4	0.0	9.4
Lane LOS	A		A
Approach Delay (s)	4.4	0.0	9.4
Approach LOS			A

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	20.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group
Lane Group Flow (vph)
v/c Ratio
Control Delay
Queue Delay
Total Delay
Queue Length 50th (m)
Queue Length 95th (m)
Internal Link Dist (m)
Turn Bay Length (m)
Base Capacity (vph)
Starvation Cap Reductn
Spillback Cap Reductn
Storage Cap Reductn
Reduced v/c Ratio

Intersection Summary

Movement	EBL	EBR	SBL	SBR	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)						
Lane Util. Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0
Turn Type						
Protected Phases						
Permitted Phases						
Actuated Green, G (s)						
Effective Green, g (s)						
Actuated g/C Ratio						
Clearance Time (s)						
Lane Grp Cap (vph)						
v/s Ratio Prot						
v/s Ratio Perm						
v/c Ratio						
Uniform Delay, d1						
Progression Factor						
Incremental Delay, d2						
Delay (s)						
Level of Service						
Approach Delay (s)	0.0		0.0		0.0	
Approach LOS	A		A		A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	3.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	410	301	182	327	378	341
Future Volume (vph)	410	301	182	327	378	341
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	672	493	298	536	620	559

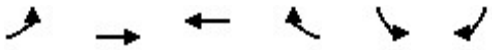
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	672	493	298	536	620	559
Volume Left (vph)	672	0	298	0	0	0
Volume Right (vph)	0	493	0	0	0	559
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	7.2	3.2	8.1	7.6	7.1	3.2
Degree Utilization, x	1.34	0.44	0.67	1.13	1.22	0.50
Capacity (veh/h)	511	1115	434	477	514	1116
Control Delay (s)	189.5	8.7	25.0	108.9	140.5	9.3
Approach Delay (s)	113.0		78.9		78.3	
Approach LOS	F		F		F	

Intersection Summary				
Delay	91.2			
Level of Service	F			
Intersection Capacity Utilization	62.7%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	586	80	135	388	79	125
Future Volume (Veh/h)	586	80	135	388	79	125
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	637	87	147	422	86	136
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			724		1396	680
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			724		1396	680
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			83		34	70
cM capacity (veh/h)			879		129	451

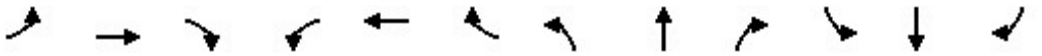
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	724	569	222
Volume Left	0	147	86
Volume Right	87	0	136
cSH	1700	879	230
Volume to Capacity	0.43	0.17	0.97
Queue Length 95th (m)	0.0	4.6	65.7
Control Delay (s)	0.0	4.2	95.9
Lane LOS		A	F
Approach Delay (s)	0.0	4.2	95.9
Approach LOS			F

Intersection Summary			
Average Delay	15.6		
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	52	232	358	0	2	99
Future Volume (veh/h)	52	232	358	0	2	99
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	57	252	389	0	2	108
Approach Volume (veh/h)		309	389		110	
Crossing Volume (veh/h)		2	57		389	
High Capacity (veh/h)		1382	1324		1020	
High v/c (veh/h)		0.22	0.29		0.11	
Low Capacity (veh/h)		1159	1106		831	
Low v/c (veh/h)		0.27	0.35		0.13	

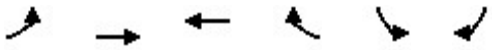
Intersection Summary				
Maximum v/c High		0.29		
Maximum v/c Low		0.35		
Intersection Capacity Utilization		50.2%	ICU Level of Service	A



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	0	15	17	0	76	5	113	25	114	96	5
Future Volume (Veh/h)	15	0	15	17	0	76	5	113	25	114	96	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	16	18	0	83	5	123	27	124	104	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	584	514	106	517	504	136	109			150		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	584	514	106	517	504	136	109			150		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	98	96	100	91	100			91		
cM capacity (veh/h)	358	422	948	429	428	912	1481			1431		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	32	101	155	233
Volume Left	16	18	5	124
Volume Right	16	83	27	5
cSH	520	760	1481	1431
Volume to Capacity	0.06	0.13	0.00	0.09
Queue Length 95th (m)	1.5	3.5	0.1	2.2
Control Delay (s)	12.4	10.5	0.3	4.5
Lane LOS	B	B	A	A
Approach Delay (s)	12.4	10.5	0.3	4.5
Approach LOS	B	B		

Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	35.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	25	210	343	81	55	17
Future Volume (Veh/h)	25	210	343	81	55	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	228	373	88	60	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			288			
pX, platoon unblocked						
vC, conflicting volume	461				699	417
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	461				699	417
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				85	97
cM capacity (veh/h)	1100				396	636

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	255	461	78
Volume Left	27	0	60
Volume Right	0	88	18
cSH	1100	1700	434
Volume to Capacity	0.02	0.27	0.18
Queue Length 95th (m)	0.6	0.0	4.9
Control Delay (s)	1.1	0.0	15.1
Lane LOS	A		C
Approach Delay (s)	1.1	0.0	15.1
Approach LOS			C

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group
Lane Group Flow (vph)
v/c Ratio
Control Delay
Queue Delay
Total Delay
Queue Length 50th (m)
Queue Length 95th (m)
Internal Link Dist (m)
Turn Bay Length (m)
Base Capacity (vph)
Starvation Cap Reductn
Spillback Cap Reductn
Storage Cap Reductn
Reduced v/c Ratio

Intersection Summary

Movement	EBL	EBR	SBL	SBR	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)						
Lane Util. Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0
Turn Type						
Protected Phases						
Permitted Phases						
Actuated Green, G (s)						
Effective Green, g (s)						
Actuated g/C Ratio						
Clearance Time (s)						
Lane Grp Cap (vph)						
v/s Ratio Prot						
v/s Ratio Perm						
v/c Ratio						
Uniform Delay, d1						
Progression Factor						
Incremental Delay, d2						
Delay (s)						
Level of Service						
Approach Delay (s)	0.0		0.0		0.0	
Approach LOS	A		A		A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	3.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	672	493	298	536	620	559
v/c Ratio	1.05	0.79	0.98	0.53	0.84	1.01
Control Delay	86.8	37.7	73.5	20.0	45.6	72.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	86.8	37.7	73.5	20.0	45.6	72.5
Queue Length 50th (m)	~172.2	83.9	45.5	77.5	131.2	~118.0
Queue Length 95th (m)	120.0	64.4	39.6	61.9	100.6	81.6
Internal Link Dist (m)	545.4			518.1	220.3	
Turn Bay Length (m)		15.0	45.0			10.0
Base Capacity (vph)	641	623	303	1019	734	551
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.05	0.79	0.98	0.53	0.84	1.01

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	410	301	182	327	378	341
Future Volume (vph)	410	301	182	327	378	341
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	4.5	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	1.00	1.00	0.79
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1789	1556	1789	1883	1883	1253
Flt Permitted	0.95	1.00	0.12	1.00	1.00	1.00
Satd. Flow (perm)	1789	1556	226	1883	1883	1253
Peak-hour factor, PHF	0.61	0.61	0.61	0.61	0.61	0.61
Adj. Flow (vph)	672	493	298	536	620	559
RTOR Reduction (vph)	0	65	0	0	0	63
Lane Group Flow (vph)	672	428	298	536	620	496
Confl. Peds. (#/hr)	2	3	71			71
Heavy Vehicles (%)	2%	2%	2%	2%	2%	3%
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	43.0	43.0	65.0	65.0	46.8	46.8
Effective Green, g (s)	43.0	43.0	65.0	65.0	46.8	46.8
Actuated g/C Ratio	0.36	0.36	0.54	0.54	0.39	0.39
Clearance Time (s)	6.0	6.0	4.5	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	641	557	300	1019	734	488
v/s Ratio Prot	c0.38		c0.11	0.28	0.33	
v/s Ratio Perm		0.27	c0.42			0.40
v/c Ratio	1.05	0.77	0.99	0.53	0.84	1.02
Uniform Delay, d1	38.5	34.1	30.7	17.6	33.3	36.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	48.9	6.3	49.9	0.5	8.8	45.0
Delay (s)	87.4	40.4	80.6	18.1	42.1	81.6
Level of Service	F	D	F	B	D	F
Approach Delay (s)	67.5			40.4	60.8	
Approach LOS	E			D	E	

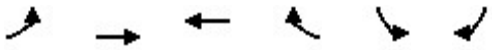
Intersection Summary			
HCM 2000 Control Delay	57.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	586	80	135	388	79	125
Future Volume (Veh/h)	586	80	135	388	79	125
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	637	87	147	422	86	136
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			724		1396	680
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			724		1396	680
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			83		34	70
cM capacity (veh/h)			879		129	451

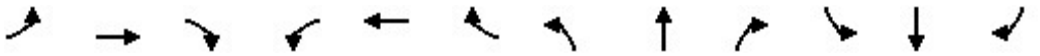
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	724	569	222
Volume Left	0	147	86
Volume Right	87	0	136
cSH	1700	879	230
Volume to Capacity	0.43	0.17	0.97
Queue Length 95th (m)	0.0	4.6	65.7
Control Delay (s)	0.0	4.2	95.9
Lane LOS		A	F
Approach Delay (s)	0.0	4.2	95.9
Approach LOS			F

Intersection Summary			
Average Delay	15.6		
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	52	232	358	0	2	99
Future Volume (veh/h)	52	232	358	0	2	99
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	57	252	389	0	2	108
Approach Volume (veh/h)		309	389		110	
Crossing Volume (veh/h)		2	57		389	
High Capacity (veh/h)		1382	1324		1020	
High v/c (veh/h)		0.22	0.29		0.11	
Low Capacity (veh/h)		1159	1106		831	
Low v/c (veh/h)		0.27	0.35		0.13	

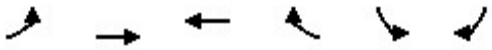
Intersection Summary				
Maximum v/c High		0.29		
Maximum v/c Low		0.35		
Intersection Capacity Utilization		50.2%	ICU Level of Service	A



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	0	15	17	0	76	5	113	25	114	96	5
Future Volume (Veh/h)	15	0	15	17	0	76	5	113	25	114	96	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	16	18	0	83	5	123	27	124	104	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	584	514	106	517	504	136	109			150		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	584	514	106	517	504	136	109			150		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	98	96	100	91	100			91		
cM capacity (veh/h)	358	422	948	429	428	912	1481			1431		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	32	101	155	233
Volume Left	16	18	5	124
Volume Right	16	83	27	5
cSH	520	760	1481	1431
Volume to Capacity	0.06	0.13	0.00	0.09
Queue Length 95th (m)	1.5	3.5	0.1	2.2
Control Delay (s)	12.4	10.5	0.3	4.5
Lane LOS	B	B	A	A
Approach Delay (s)	12.4	10.5	0.3	4.5
Approach LOS	B	B		

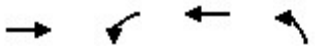
Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	35.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	25	210	343	81	55	17
Future Volume (Veh/h)	25	210	343	81	55	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	228	373	88	60	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			288			
pX, platoon unblocked						
vC, conflicting volume	461				699	417
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	461				699	417
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				85	97
cM capacity (veh/h)	1100				396	636

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	255	461	78
Volume Left	27	0	60
Volume Right	0	88	18
cSH	1100	1700	434
Volume to Capacity	0.02	0.27	0.18
Queue Length 95th (m)	0.6	0.0	4.9
Control Delay (s)	1.1	0.0	15.1
Lane LOS	A		C
Approach Delay (s)	1.1	0.0	15.1
Approach LOS			C

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBT	WBL	WBT	NBL
Lane Group Flow (vph)	724	147	422	222
v/c Ratio	0.76	0.61	0.44	0.51
Control Delay	14.5	20.7	8.5	14.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	14.5	20.7	8.5	14.7
Queue Length 50th (m)	35.8	6.6	16.9	7.0
Queue Length 95th (m)	85.2	27.3	40.0	28.6
Internal Link Dist (m)	358.3		545.4	116.4
Turn Bay Length (m)		30.0		
Base Capacity (vph)	1573	399	1596	826
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.46	0.37	0.26	0.27

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	586	80	135	388	79	125
Future Volume (vph)	586	80	135	388	79	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1853		1789	1883	1695	
Flt Permitted	1.00		0.25	1.00	0.98	
Satd. Flow (perm)	1853		471	1883	1695	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	637	87	147	422	86	136
RTOR Reduction (vph)	8	0	0	0	89	0
Lane Group Flow (vph)	716	0	147	422	133	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	4			8	2	
Permitted Phases			8			
Actuated Green, G (s)	23.2		23.2	23.2	9.3	
Effective Green, g (s)	23.2		23.2	23.2	9.3	
Actuated g/C Ratio	0.52		0.52	0.52	0.21	
Clearance Time (s)	6.0		6.0	6.0	6.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	966		245	981	354	
v/s Ratio Prot	c0.39			0.22	c0.08	
v/s Ratio Perm			0.31			
v/c Ratio	0.74		0.60	0.43	0.38	
Uniform Delay, d1	8.3		7.4	6.6	15.1	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.1		3.9	0.3	0.7	
Delay (s)	11.4		11.3	6.9	15.8	
Level of Service	B		B	A	B	
Approach Delay (s)	11.4			8.0	15.8	
Approach LOS	B			A	B	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	44.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	586	80	135	388	79	125
Future Volume (Veh/h)	586	80	135	388	79	125
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	637	87	147	422	86	136
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	Raised			Raised		
Median storage veh)	1			1		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			724		1396	680
vC1, stage 1 conf vol					680	
vC2, stage 2 conf vol					716	
vCu, unblocked vol			724		1396	680
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			83		67	70
cM capacity (veh/h)			879		262	451

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	724	147	422	222
Volume Left	0	147	0	86
Volume Right	87	0	0	136
cSH	1700	879	1700	353
Volume to Capacity	0.43	0.17	0.25	0.63
Queue Length 95th (m)	0.0	4.6	0.0	31.0
Control Delay (s)	0.0	9.9	0.0	31.1
Lane LOS		A		D
Approach Delay (s)	0.0	2.6		31.1
Approach LOS				D

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group
Lane Group Flow (vph)
v/c Ratio
Control Delay
Queue Delay
Total Delay
Queue Length 50th (m)
Queue Length 95th (m)
Internal Link Dist (m)
Turn Bay Length (m)
Base Capacity (vph)
Starvation Cap Reductn
Spillback Cap Reductn
Storage Cap Reductn
Reduced v/c Ratio

Intersection Summary

Movement	EBL	EBR	SBL	SBR	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)						
Lane Util. Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0
Turn Type						
Protected Phases						
Permitted Phases						
Actuated Green, G (s)						
Effective Green, g (s)						
Actuated g/C Ratio						
Clearance Time (s)						
Lane Grp Cap (vph)						
v/s Ratio Prot						
v/s Ratio Perm						
v/c Ratio						
Uniform Delay, d1						
Progression Factor						
Incremental Delay, d2						
Delay (s)						
Level of Service						
Approach Delay (s)	0.0		0.0		0.0	
Approach LOS	A		A		A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	3.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Traffic Volume (vph)	313	215	192	326	228	384
Future Volume (vph)	313	215	192	326	228	384
Peak Hour Factor	0.61	0.61	0.61	0.61	0.61	0.61
Hourly flow rate (vph)	513	352	315	534	374	630

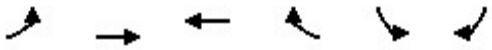
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	513	352	315	534	374	630
Volume Left (vph)	513	0	315	0	0	0
Volume Right (vph)	0	352	0	0	0	630
Hadj (s)	0.23	-0.57	0.53	0.03	0.03	-0.55
Departure Headway (s)	6.9	3.2	7.9	7.4	7.1	3.2
Degree Utilization, x	0.98	0.31	0.69	1.10	0.74	0.56
Capacity (veh/h)	513	1113	446	498	498	1117
Control Delay (s)	61.0	7.7	25.7	95.2	27.6	10.2
Approach Delay (s)	39.3		69.4		16.7	
Approach LOS	E		F		C	

Intersection Summary			
Delay	40.4		
Level of Service	E		
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	421	171	195	381	116	107
Future Volume (Veh/h)	421	171	195	381	116	107
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	458	186	212	414	126	116
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			644		1389	551
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			644		1389	551
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			77		0	78
cM capacity (veh/h)			941		122	534

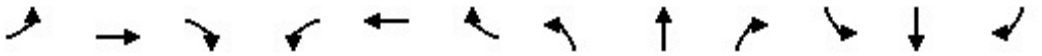
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	644	626	242
Volume Left	0	212	126
Volume Right	186	0	116
cSH	1700	941	193
Volume to Capacity	0.38	0.23	1.25
Queue Length 95th (m)	0.0	6.6	99.2
Control Delay (s)	0.0	5.3	197.6
Lane LOS		A	F
Approach Delay (s)	0.0	5.3	197.6
Approach LOS			F

Intersection Summary			
Average Delay	33.8		
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	32	108	65	1	2	56
Future Volume (veh/h)	32	108	65	1	2	56
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	117	71	1	2	61
Approach Volume (veh/h)		152	72		63	
Crossing Volume (veh/h)		2	35		71	
High Capacity (veh/h)		1382	1347		1310	
High v/c (veh/h)		0.11	0.05		0.05	
Low Capacity (veh/h)		1159	1127		1093	
Low v/c (veh/h)		0.13	0.06		0.06	

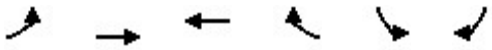
Intersection Summary				
Maximum v/c High		0.11		
Maximum v/c Low		0.13		
Intersection Capacity Utilization		24.4%	ICU Level of Service	A



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	5	30	0	140	15	78	28	130	221	15
Future Volume (Veh/h)	5	0	5	30	0	140	15	78	28	130	221	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	33	0	152	16	85	30	141	240	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	814	677	248	667	670	100	256			115		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	814	677	248	667	670	100	256			115		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	90	100	84	99			90		
cM capacity (veh/h)	229	335	791	340	338	956	1309			1474		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	10	185	131	397
Volume Left	5	33	16	141
Volume Right	5	152	30	16
cSH	355	722	1309	1474
Volume to Capacity	0.03	0.26	0.01	0.10
Queue Length 95th (m)	0.7	7.7	0.3	2.4
Control Delay (s)	15.4	11.7	1.0	3.3
Lane LOS	C	B	A	A
Approach Delay (s)	15.4	11.7	1.0	3.3
Approach LOS	C	B		

Intersection Summary				
Average Delay	5.2			
Intersection Capacity Utilization	43.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	28	83	42	94	101	30
Future Volume (Veh/h)	28	83	42	94	101	30
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	90	46	102	110	33
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			288			
pX, platoon unblocked						
vC, conflicting volume	148				247	97
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	148				247	97
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				85	97
cM capacity (veh/h)	1434				726	959

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	120	148	143
Volume Left	30	0	110
Volume Right	0	102	33
cSH	1434	1700	769
Volume to Capacity	0.02	0.09	0.19
Queue Length 95th (m)	0.5	0.0	5.2
Control Delay (s)	2.0	0.0	10.7
Lane LOS	A		B
Approach Delay (s)	2.0	0.0	10.7
Approach LOS			B

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	31.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group
Lane Group Flow (vph)
v/c Ratio
Control Delay
Queue Delay
Total Delay
Queue Length 50th (m)
Queue Length 95th (m)
Internal Link Dist (m)
Turn Bay Length (m)
Base Capacity (vph)
Starvation Cap Reductn
Spillback Cap Reductn
Storage Cap Reductn
Reduced v/c Ratio

Intersection Summary

Movement	EBL	EBR	SBL	SBR	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)						
Lane Util. Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0
Turn Type						
Protected Phases						
Permitted Phases						
Actuated Green, G (s)						
Effective Green, g (s)						
Actuated g/C Ratio						
Clearance Time (s)						
Lane Grp Cap (vph)						
v/s Ratio Prot						
v/s Ratio Perm						
v/c Ratio						
Uniform Delay, d1						
Progression Factor						
Incremental Delay, d2						
Delay (s)						
Level of Service						
Approach Delay (s)	0.0		0.0		0.0	
Approach LOS	A		A		A	

Intersection Summary			
HCM 2000 Control Delay	0.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	3.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	513	352	315	534	374	630
v/c Ratio	0.92	0.60	0.80	0.55	0.55	0.92
Control Delay	49.2	17.7	29.9	14.1	21.6	32.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.2	17.7	29.9	14.1	21.6	32.2
Queue Length 50th (m)	69.9	24.2	23.4	45.6	39.5	44.0
Queue Length 95th (m)	62.0	23.2	23.4	40.1	37.9	29.8
Internal Link Dist (m)	545.4			518.1	220.3	
Turn Bay Length (m)		15.0	45.0			10.0
Base Capacity (vph)	587	607	393	1075	780	744
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.58	0.80	0.50	0.48	0.85

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	313	215	192	326	228	384
Future Volume (vph)	313	215	192	326	228	384
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	0.87
Flpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1789	1561	1763	1883	1883	1376
Flt Permitted	0.95	1.00	0.34	1.00	1.00	1.00
Satd. Flow (perm)	1789	1561	622	1883	1883	1376
Peak-hour factor, PHF	0.61	0.61	0.61	0.61	0.61	0.61
Adj. Flow (vph)	513	352	315	534	374	630
RTOR Reduction (vph)	0	97	0	0	0	195
Lane Group Flow (vph)	513	255	315	534	374	435
Confl. Peds. (#/hr)	2	3	71			71
Heavy Vehicles (%)	2%	2%	2%	2%	2%	3%
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	22.2	22.2	36.5	36.5	25.4	25.4
Effective Green, g (s)	22.2	22.2	36.5	36.5	25.4	25.4
Actuated g/C Ratio	0.31	0.31	0.52	0.52	0.36	0.36
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	561	490	403	972	676	494
v/s Ratio Prot	c0.29		c0.06	0.28	0.20	
v/s Ratio Perm		0.16	0.35			c0.32
v/c Ratio	0.91	0.52	0.78	0.55	0.55	0.88
Uniform Delay, d1	23.3	19.9	14.4	11.5	18.1	21.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	19.5	1.0	9.5	0.6	1.0	16.2
Delay (s)	42.8	20.9	23.9	12.2	19.1	37.5
Level of Service	D	C	C	B	B	D
Approach Delay (s)	33.9			16.5	30.6	
Approach LOS	C			B	C	

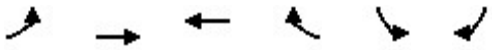
Intersection Summary			
HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	70.7	Sum of lost time (s)	18.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	421	171	195	381	116	107
Future Volume (Veh/h)	421	171	195	381	116	107
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	458	186	212	414	126	116
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			644		1389	551
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			644		1389	551
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			77		0	78
cM capacity (veh/h)			941		122	534

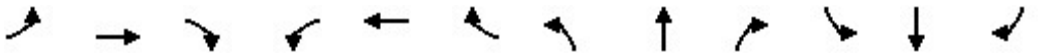
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	644	626	242
Volume Left	0	212	126
Volume Right	186	0	116
cSH	1700	941	193
Volume to Capacity	0.38	0.23	1.25
Queue Length 95th (m)	0.0	6.6	99.2
Control Delay (s)	0.0	5.3	197.6
Lane LOS		A	F
Approach Delay (s)	0.0	5.3	197.6
Approach LOS			F

Intersection Summary			
Average Delay	33.8		
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Right Turn Channelized						
Traffic Volume (veh/h)	32	108	65	1	2	56
Future Volume (veh/h)	32	108	65	1	2	56
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	117	71	1	2	61
Approach Volume (veh/h)		152	72		63	
Crossing Volume (veh/h)		2	35		71	
High Capacity (veh/h)		1382	1347		1310	
High v/c (veh/h)		0.11	0.05		0.05	
Low Capacity (veh/h)		1159	1127		1093	
Low v/c (veh/h)		0.13	0.06		0.06	

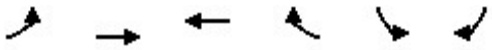
Intersection Summary			
Maximum v/c High	0.11		
Maximum v/c Low	0.13		
Intersection Capacity Utilization	24.4%	ICU Level of Service	A



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	5	30	0	140	15	78	28	130	221	15
Future Volume (Veh/h)	5	0	5	30	0	140	15	78	28	130	221	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	33	0	152	16	85	30	141	240	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	814	677	248	667	670	100	256			115		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	814	677	248	667	670	100	256			115		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	90	100	84	99			90		
cM capacity (veh/h)	229	335	791	340	338	956	1309			1474		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	10	185	131	397
Volume Left	5	33	16	141
Volume Right	5	152	30	16
cSH	355	722	1309	1474
Volume to Capacity	0.03	0.26	0.01	0.10
Queue Length 95th (m)	0.7	7.7	0.3	2.4
Control Delay (s)	15.4	11.7	1.0	3.3
Lane LOS	C	B	A	A
Approach Delay (s)	15.4	11.7	1.0	3.3
Approach LOS	C	B		

Intersection Summary				
Average Delay	5.2			
Intersection Capacity Utilization	43.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	28	83	42	94	101	30
Future Volume (Veh/h)	28	83	42	94	101	30
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	90	46	102	110	33
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			288			
pX, platoon unblocked						
vC, conflicting volume	148				247	97
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	148				247	97
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				85	97
cM capacity (veh/h)	1434				726	959

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	120	148	143
Volume Left	30	0	110
Volume Right	0	102	33
cSH	1434	1700	769
Volume to Capacity	0.02	0.09	0.19
Queue Length 95th (m)	0.5	0.0	5.2
Control Delay (s)	2.0	0.0	10.7
Lane LOS	A		B
Approach Delay (s)	2.0	0.0	10.7
Approach LOS			B

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	31.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBL
Lane Group Flow (vph)	644	212	414	242
v/c Ratio	0.70	0.77	0.45	0.55
Control Delay	13.2	31.3	9.4	20.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.2	31.3	9.4	20.4
Queue Length 50th (m)	31.1	11.9	18.4	12.9
Queue Length 95th (m)	74.6	#51.9	43.1	42.9
Internal Link Dist (m)	358.3		545.4	116.4
Turn Bay Length (m)		30.0		
Base Capacity (vph)	1751	538	1820	730
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.37	0.39	0.23	0.33

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	421	171	195	381	116	107
Future Volume (vph)	421	171	195	381	116	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.96		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	1810		1789	1883	1717	
Flt Permitted	1.00		0.30	1.00	0.97	
Satd. Flow (perm)	1810		558	1883	1717	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	458	186	212	414	126	116
RTOR Reduction (vph)	24	0	0	0	35	0
Lane Group Flow (vph)	620	0	212	414	207	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	4			8	2	
Permitted Phases			8			
Actuated Green, G (s)	23.5		23.5	23.5	11.2	
Effective Green, g (s)	23.5		23.5	23.5	11.2	
Actuated g/C Ratio	0.50		0.50	0.50	0.24	
Clearance Time (s)	6.0		6.0	6.0	6.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	910		280	947	411	
v/s Ratio Prot	0.34			0.22	c0.12	
v/s Ratio Perm			c0.38			
v/c Ratio	0.68		0.76	0.44	0.50	
Uniform Delay, d1	8.8		9.3	7.4	15.3	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	2.1		11.1	0.3	1.0	
Delay (s)	10.9		20.4	7.7	16.3	
Level of Service	B		C	A	B	
Approach Delay (s)	10.9			12.0	16.3	
Approach LOS	B			B	B	

Intersection Summary			
HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	46.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	421	171	195	381	116	107
Future Volume (Veh/h)	421	171	195	381	116	107
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	458	186	212	414	126	116
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	Raised			Raised		
Median storage veh)	1			1		
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			644		1389	551
vC1, stage 1 conf vol					551	
vC2, stage 2 conf vol					838	
vCu, unblocked vol			644		1389	551
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			77		48	78
cM capacity (veh/h)			941		241	534

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	644	212	414	242
Volume Left	0	212	0	126
Volume Right	186	0	0	116
cSH	1700	941	1700	327
Volume to Capacity	0.38	0.23	0.24	0.74
Queue Length 95th (m)	0.0	6.6	0.0	42.5
Control Delay (s)	0.0	9.9	0.0	41.7
Lane LOS		A		E
Approach Delay (s)	0.0	3.4		41.7
Approach LOS				E

Intersection Summary			
Average Delay	8.1		
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

APPENDIX D:

Traffic Signal Warrant Analysis Spreadsheets

Appendix

D

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Frontier Trl	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2024 Background

CHECK SHEET

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB								5000	0			
Bison Dr	EB	1					1	y	975	0			
Frontier Trl	NB	1							5000	0			
Frontier Trl	SB					1		y	5000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Frontier Trl NB right turns significantly impeded by through movements? (y/n)	n
Are the Frontier Trl SB right turns significantly impeded by through movements? (y/n)	n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)	n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)	n

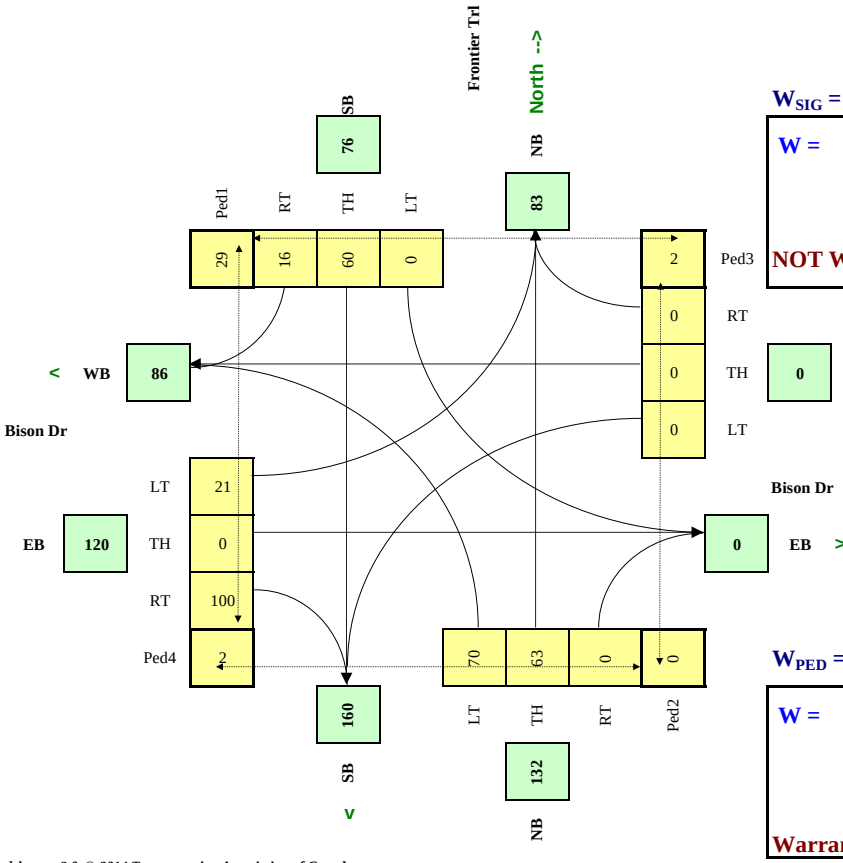
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Frontier Trl	NS	50	2.0%	y	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	417	377	0	0	360	98	0	0	0	123	0	598	175		10	10
Total (6-hour peak)	417	377	0	0	360	98	0	0	0	123	0	598	175	0	10	10
Average (6-hour peak)	70	63	0	0	60	16	0	0	0	21	0	100	29	0	2	2
Actual Pedestrian Crossing Distance (m)																

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	18	10	8
		Veh	*Ped*

NOT Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Frontier Trl	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2027 Background

CHECK SHEET

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB								5000	0			
Bison Dr	EB	1					1	y	975	0			
Frontier Trl	NB	1							5000	0			
Frontier Trl	SB					1		y	5000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Frontier Trl NB right turns significantly impeded by through movements? (y/n)		n
Are the Frontier Trl SB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)		n

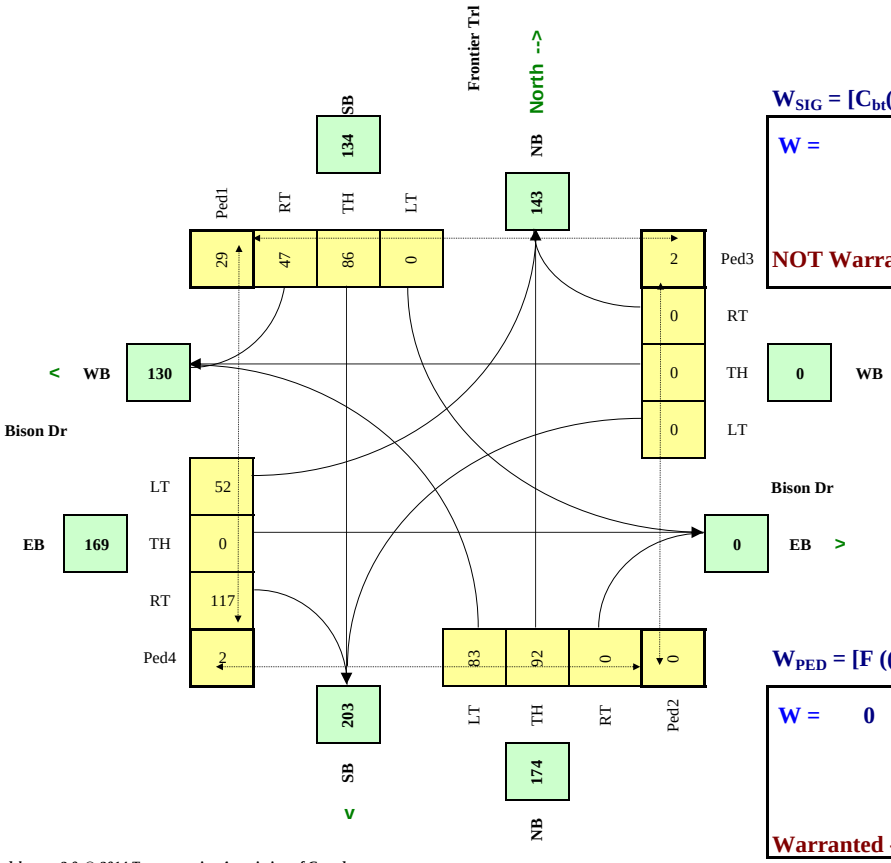
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Frontier Trl	NS	50	2.0%	y	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	495	549	0	0	518	284	0	0	0	311	0	702	175		10	10
Total (6-hour peak)	495	549	0	0	518	284	0	0	0	311	0	702	175	0	10	10
Average (6-hour peak)	83	92	0	0	86	47	0	0	0	52	0	117	29	0	2	2
													Actual Pedestrian Crossing Distance (m)			

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	34	24	10
		Veh	Ped

NOT Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Frontier Trl	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2027 Phase 1 Post-Dev

CHECK SHEET

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB								5000	0			
Bison Dr	EB	1					1	y	975	0			
Frontier Trl	NB	1							5000	0			
Frontier Trl	SB					1		y	5000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Frontier Trl NB right turns significantly impeded by through movements? (y/n)		n
Are the Frontier Trl SB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)		n

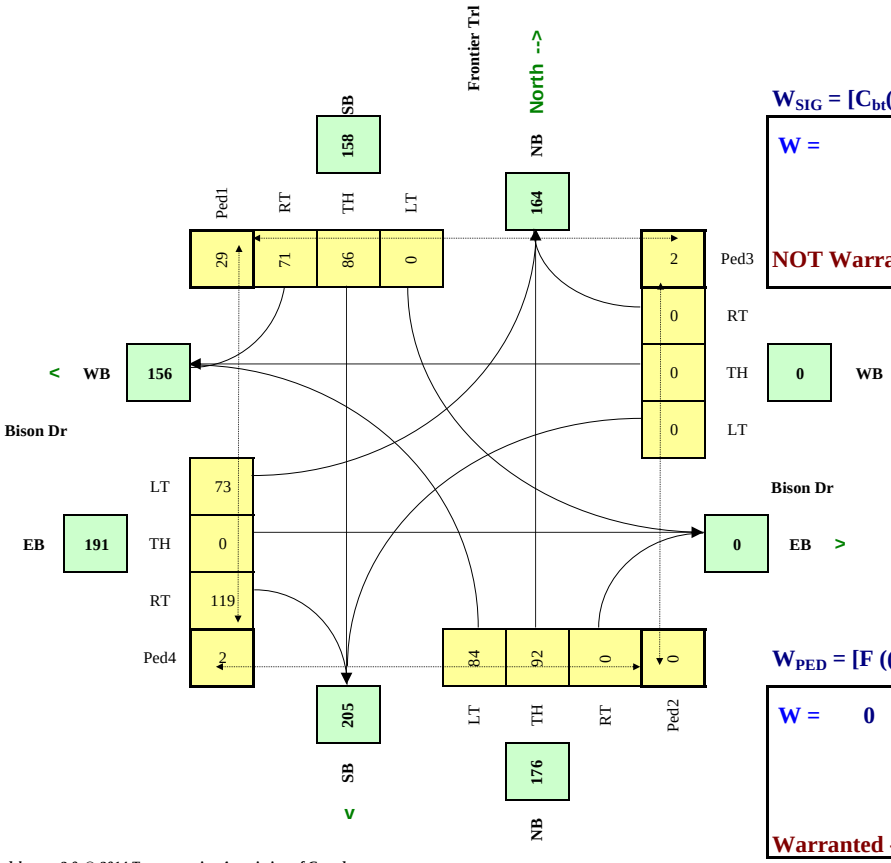
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Frontier Trl	NS	50	2.0%	y	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	506	549	0	0	518	427	0	0	0	437	0	711	175		10	10
Total (6-hour peak)	506	549	0	0	518	427	0	0	0	437	0	711	175	0	10	10
Average (6-hour peak)	84	92	0	0	86	71	0	0	0	73	0	119	29	0	2	2
													Actual Pedestrian Crossing Distance (m)			

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	41	29	12
		Veh	*Ped*

NOT Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Frontier Trl	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2041 Background
	CHECK SHEET		

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB								5000	0			
Bison Dr	EB	1					1	y	975	0			
Frontier Trl	NB	1							5000	0			
Frontier Trl	SB					1		y	5000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Frontier Trl NB right turns significantly impeded by through movements? (y/n)		n
Are the Frontier Trl SB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)		n

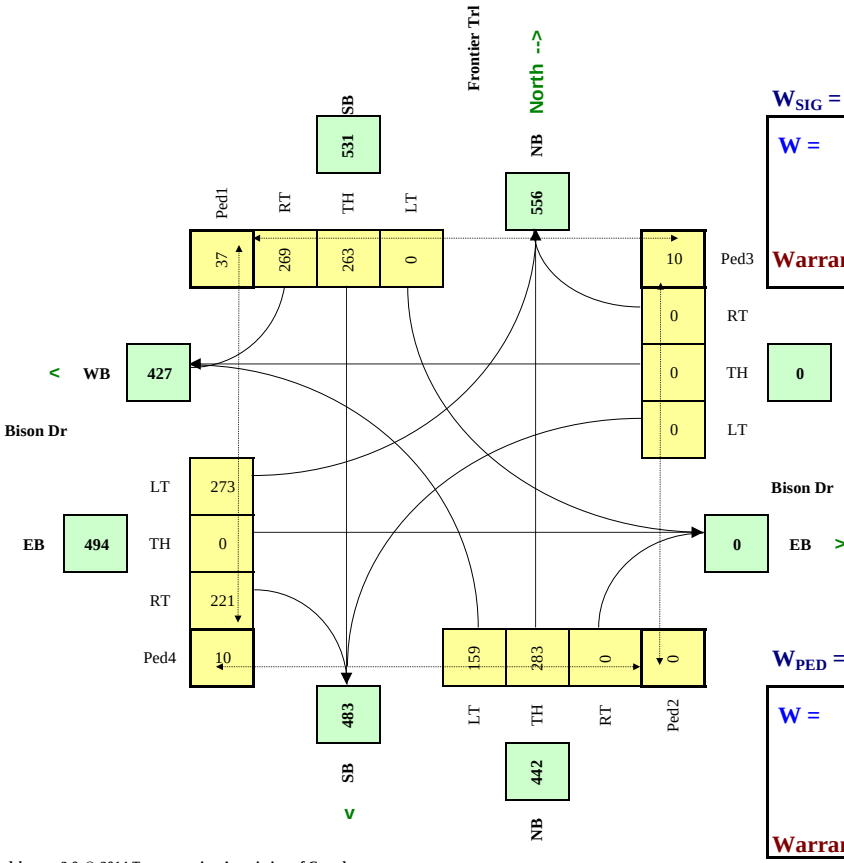
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Frontier Trl	NS	50	2.0%	y	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	952	1698	0	0	1576	1612	0	0	0	1638	0	1323	220		60	60
Total (6-hour peak)	952	1,698	0	0	1,576	1,612	0	0	0	1,638	0	1,323	220	0	60	60
Average (6-hour peak)	159	283	0	0	263	269	0	0	0	273	0	221	37	0	10	10
													Actual Pedestrian Crossing Distance (m)			

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	269	230	39
		Veh	Ped

Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr
Side Street (name)	Frontier Trl
Quadrant / Int #	
	CHECK SHEET
For Warrant Calculation Results, please hit 'Page Down'	

Direction (EW or NS)	EW
Direction (EW or NS)	NS
Comments	2041 Phase 2 Post-Dev

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB								5000	0			
Bison Dr	EB	1					1	y	975	0			
Frontier Trl	NB	1							5000	0			
Frontier Trl	SB					1		y	5000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Frontier Trl NB right turns significantly impeded by through movements? (y/n)		n
Are the Frontier Trl SB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)		n

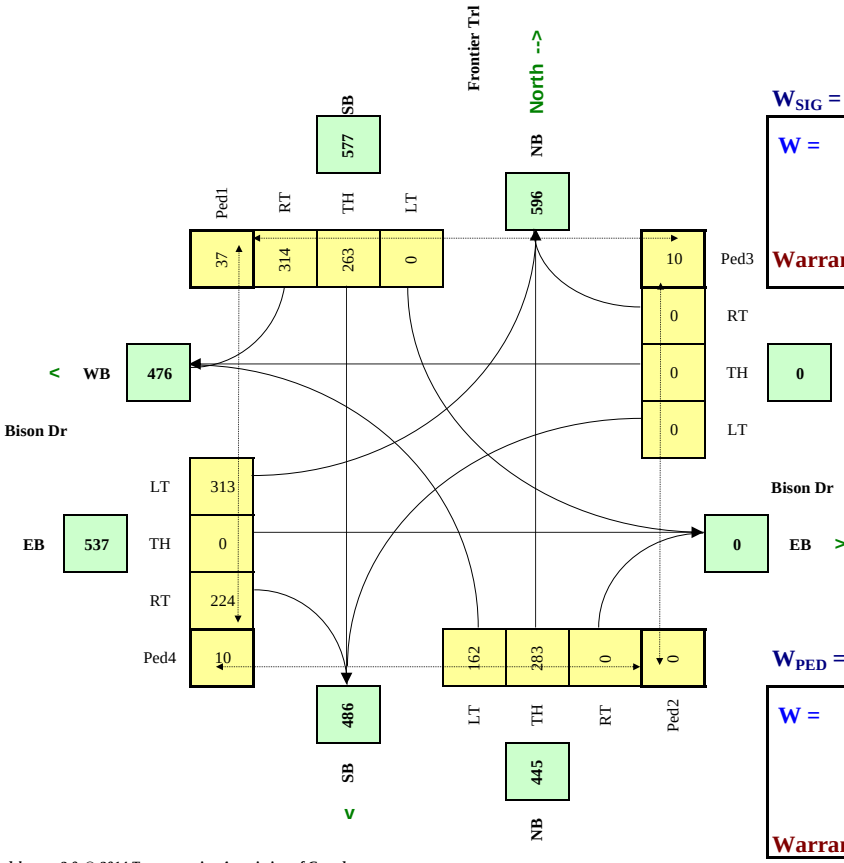
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Frontier Trl	NS	50	2.0%	y	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	972	1698	0	0	1576	1885	0	0	0	1880	0	1342	220		60	60
Total (6-hour peak)	972	1,698	0	0	1,576	1,885	0	0	0	1,880	0	1,342	220	0	60	60
Average (6-hour peak)	162	283	0	0	263	314	0	0	0	313	0	224	37	0	10	10
													Actual Pedestrian Crossing Distance (m)			

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	301	257	44
		Veh	*Ped*

Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Frontier Trl	Direction (EW or NS)	NS
Quadrant / Int #		Comments	Sensitivity: 2033 BG warrants signals
	CHECK SHEET		

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB								5000	0			
Bison Dr	EB	1					1	y	975	0			
Frontier Trl	NB	1							5000	0			
Frontier Trl	SB					1		y	5000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Frontier Trl NB right turns significantly impeded by through movements? (y/n)		n
Are the Frontier Trl SB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)		n

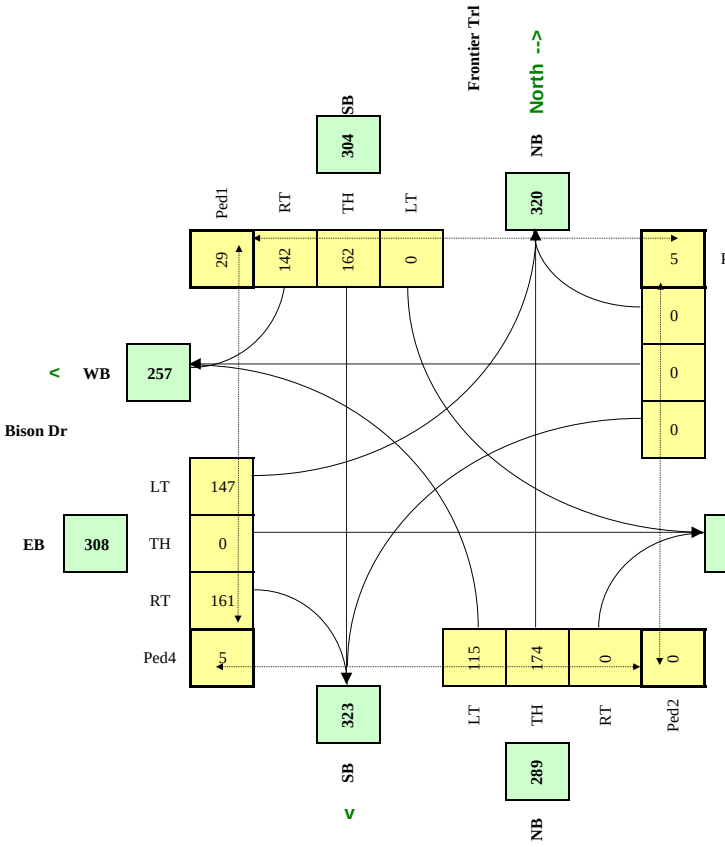
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Frontier Trl	NS	50	2.0%	y	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	691	1041	0	0	971	853	0	0	0	880	0	968	175		30	30
Total (6-hour peak)	691	1,041	0	0	971	853	0	0	0	880	0	968	175	0	30	30
Average (6-hour peak)	115	174	0	0	162	142	0	0	0	147	0	161	29	0	5	5
													Actual Pedestrian Crossing Distance (m)			

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	107	87	20
		Veh	Ped

Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr
Side Street (name)	Frontier Trl
Quadrant / Int #	
	CHECK SHEET

For Warrant Calculation Results, please hit 'Page Down'

Direction (EW or NS)	EW
Direction (EW or NS)	NS
Comments	Sensitivity: 2032 PD warrants signals

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB								5000	0			
Bison Dr	EB	1					1	y	975	0			
Frontier Trl	NB	1							5000	0			
Frontier Trl	SB					1		y	5000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Frontier Trl NB right turns significantly impeded by through movements? (y/n)		n
Are the Frontier Trl SB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)		n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)		n

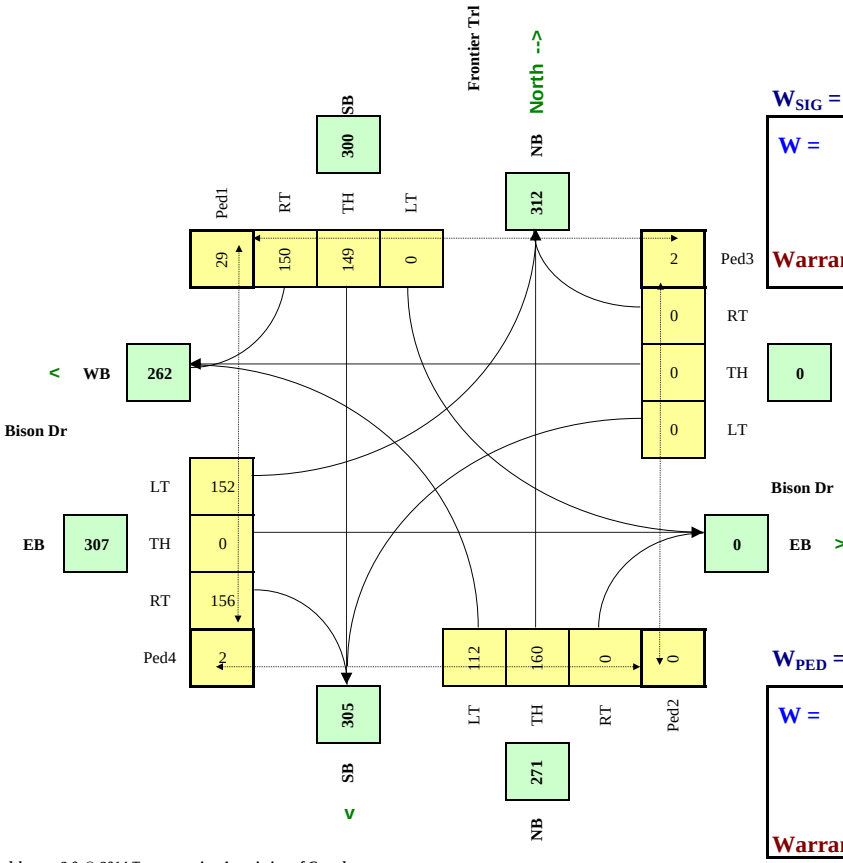
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Frontier Trl	NS	50	2.0%	y	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	669	959	0	0	896	901	0	0	0	911	0	933	175		10	10
Total (6-hour peak)	669	959	0	0	896	901	0	0	0	911	0	933	175	0	10	10
Average (6-hour peak)	112	160	0	0	149	150	0	0	0	152	0	156	29	0	2	2
													Actual Pedestrian Crossing Distance (m)			

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	102	83	19
		Veh	Ped

Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Ruth Cr	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2027 Background
For Warrant Calculation Results, please hit 'Page Down'	CHECK SHEET		

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB		1						5000	1			
Bison Dr	EB					1			400	1			
Ruth Cr	NB				1				5000	1			
Ruth Cr	SB								5000	0			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Ruth Cr NB right turns significantly impeded by through movements? (y/n)	n
Are the Ruth Cr SB right turns significantly impeded by through movements? (y/n)	n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)	n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)	n

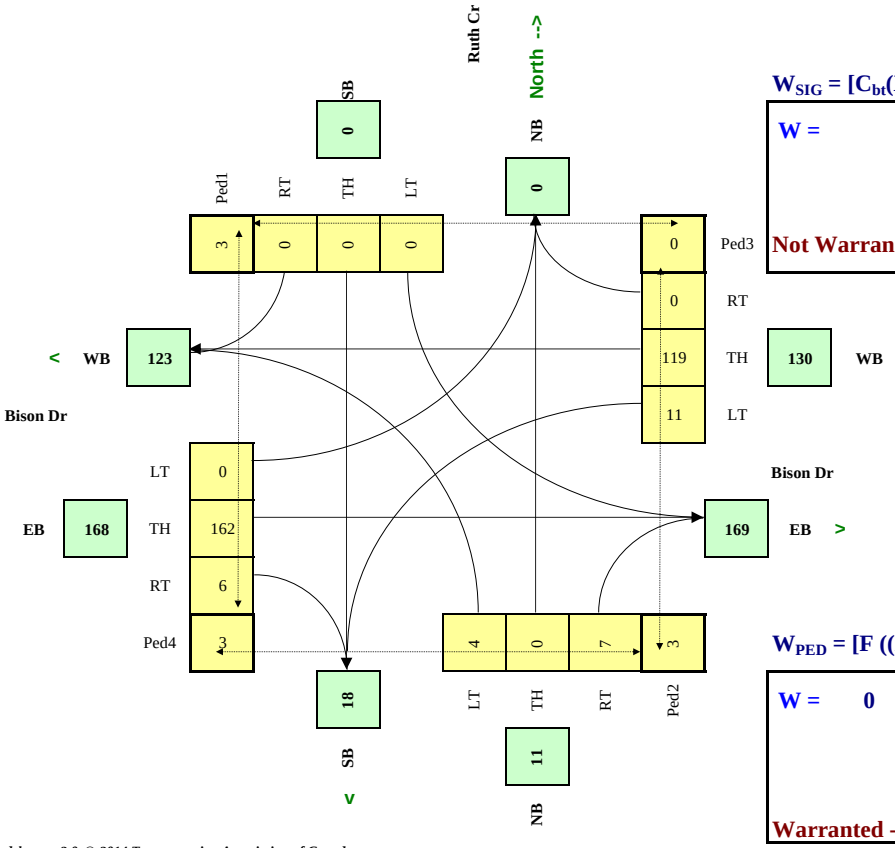
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Ruth Cr	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input		NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
		LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00		25	0	41	0	0	0	68	711	0	0	972	38	15	15		15
Total (6-hour peak)		25	0	41	0	0	0	68	711	0	0	972	38	15	15	0	15
Average (6-hour peak)		4	0	7	0	0	0	11	119	0	0	162	6	3	3	0	3
														Actual Pedestrian Crossing Distance (m)			

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	3	2	1
		Veh	Ped

Not Warranted - Vs<75

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Ruth Cr	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2027 Phase 1 Post-Dev

CHECK SHEET

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB		1						5000	1			
Bison Dr	EB					1			400	1			
Ruth Cr	NB				1				5000	1			
Ruth Cr	SB								5000	0			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Ruth Cr NB right turns significantly impeded by through movements? (y/n)	n
Are the Ruth Cr SB right turns significantly impeded by through movements? (y/n)	n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)	n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)	n

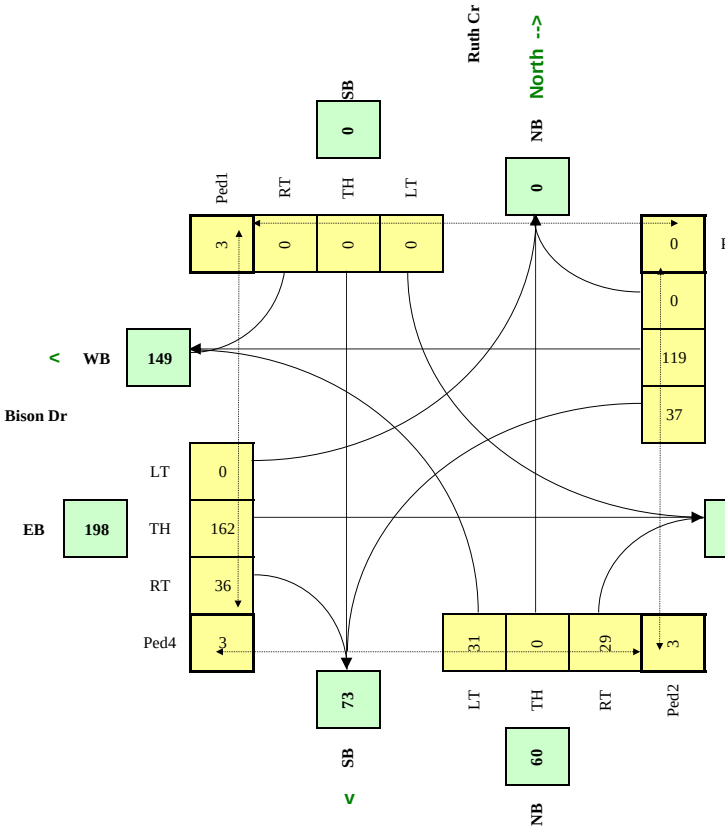
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Ruth Cr	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	184	0	176	0	0	0	221	711	0	0	972	218	15	15		15
Total (6-hour peak)	184	0	176	0	0	0	221	711	0	0	972	218	15	15	0	15
Average (6-hour peak)	31	0	29	0	0	0	37	119	0	0	162	36	3	3	0	3
Actual Pedestrian Crossing Distance (m)																

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W = 12 10 2

Veh *Ped*

Not Warranted - Vs<75

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Ruth Cr	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2041 Background

CHECK SHEET

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB		1						5000	1			
Bison Dr	EB					1			400	1			
Ruth Cr	NB				1				5000	1			
Ruth Cr	SB								5000	0			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Ruth Cr NB right turns significantly impeded by through movements? (y/n)	n	
Are the Ruth Cr SB right turns significantly impeded by through movements? (y/n)	n	
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)	n	
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)	n	

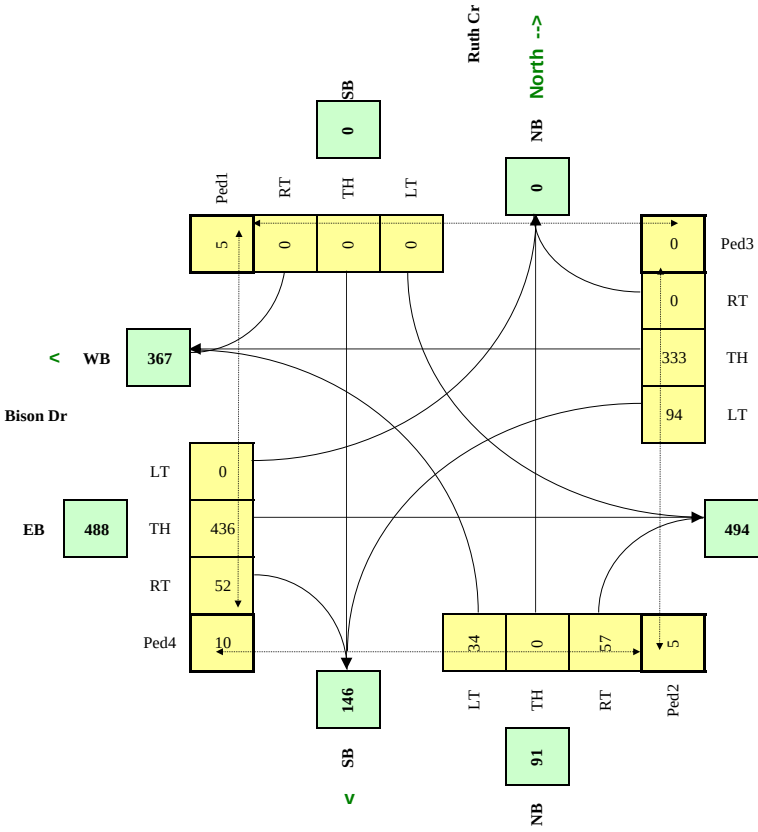
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Ruth Cr	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input		NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
		LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00		205	0	343	0	0	0	564	1999	0	0	2618	312	30	30		60
Total (6-hour peak)		205	0	343	0	0	0	564	1,999	0	0	2,618	312	30	30	0	60
Average (6-hour peak)		34	0	57	0	0	0	94	333	0	0	436	52	5	5	0	10
														Actual Pedestrian Crossing Distance (m)			

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	56	47	9
		Veh	Ped

Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Ruth Cr	Direction (EW or NS)	NS
Quadrant / Int #		Comments	2041 Phase 2 Post-Dev
	CHECK SHEET		

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB		1						5000	1			
Bison Dr	EB					1			400	1			
Ruth Cr	NB				1				5000	1			
Ruth Cr	SB								5000	0			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Ruth Cr NB right turns significantly impeded by through movements? (y/n)	n	
Are the Ruth Cr SB right turns significantly impeded by through movements? (y/n)	n	
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)	n	
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)	n	

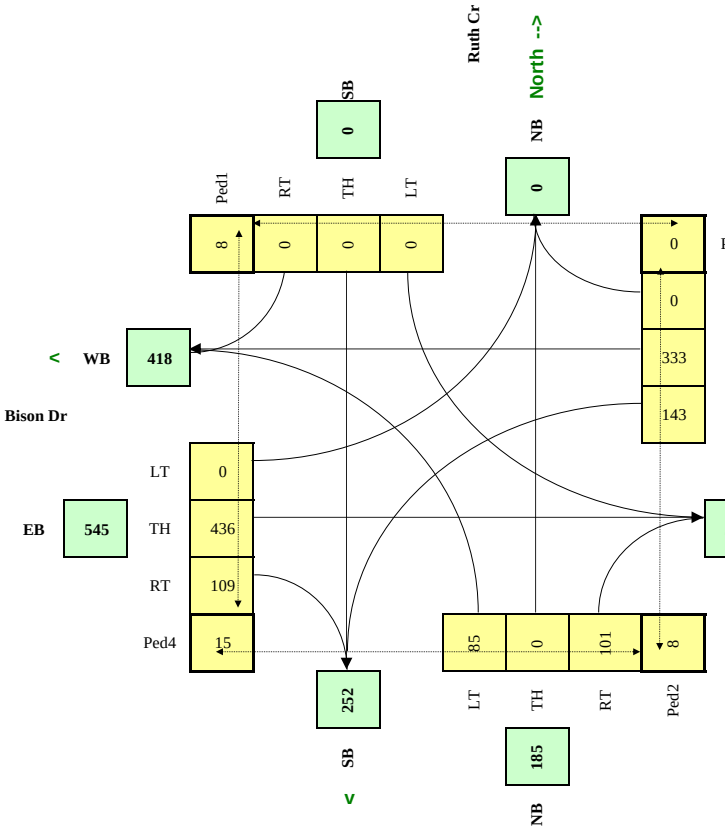
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Ruth Cr	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	507	0	603	0	0	0	858	1999	0	0	2618	653	45	45		90
Total (6-hour peak)	507	0	603	0	0	0	858	1,999	0	0	2,618	653	45	45	0	90
Average (6-hour peak)	85	0	101	0	0	0	143	333	0	0	436	109	8	8	0	15
Actual Pedestrian Crossing Distance (m)																

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	112	96	16
		Veh	*Ped*

Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

City of Winnipeg - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Bison Dr	Direction (EW or NS)	EW
Side Street (name)	Ruth Cr	Direction (EW or NS)	NS
Quadrant / Int #		Comments	PD Sensitivity: 2041 BG + Phase 1 PD

CHECK SHEET

For Warrant Calculation Results, please hit 'Page Down'

Road Authority:	City of Winnipeg
City:	Winnipeg
Analysis Date:	
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Bison Dr	WB		1						5000	1			
Bison Dr	EB					1			400	1			
Ruth Cr	NB				1				5000	1			
Ruth Cr	SB								5000	0			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn		1,650
Through		1,800
Right Turn		1,500

Are the Ruth Cr NB right turns significantly impeded by through movements? (y/n)	n
Are the Ruth Cr SB right turns significantly impeded by through movements? (y/n)	n
Are the Bison Dr WB right turns significantly impeded by through movements? (y/n)	n
Are the Bison Dr EB right turns significantly impeded by through movements? (y/n)	n

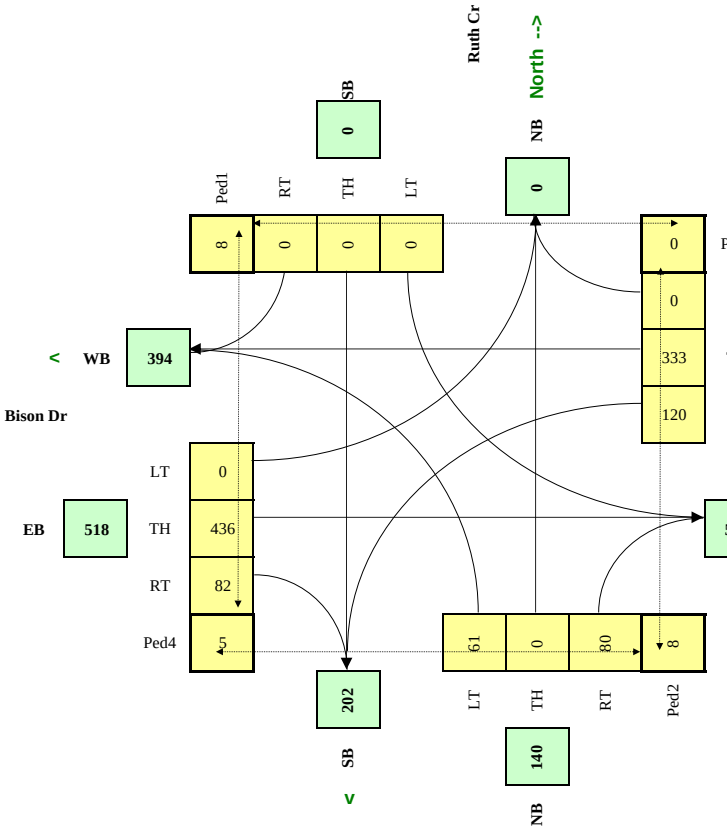
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	750,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Bison Dr	EW	50	2.0%	y	0.0
Ruth Cr	NS	50	2.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	364	0	478	0	0	0	717	1999	0	0	2618	492	45	45		30
Total (6-hour peak)	364	0	478	0	0	0	717	1,999	0	0	2,618	492	45	45	0	30
Average (6-hour peak)	61	0	80	0	0	0	120	333	0	0	436	82	8	8	0	5
Actual Pedestrian Crossing Distance (m)																

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	87	72	15
		Veh	Ped

Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

Appendix

E

APPENDIX E:

Parking Calculations

Cindy Klassen Rec Centre Parking Utilization

Date	Time	Vehicles Counted	Available Supply	Utilization
Friday, April 5, 2024	11:00	78	186	42%
Friday, April 5, 2024	15:00	60	186	32%
Friday, April 5, 2024	15:15	60	186	32%
Friday, April 5, 2024	15:30	76	186	41%
Friday, April 5, 2024	15:45	56	186	30%
Friday, April 5, 2024	18:00	69	186	37%
Friday, April 5, 2024	18:15	70	186	38%
Saturday, April 6, 2024	9:30	63	186	34%
Saturday, April 6, 2024	15:00	50	186	27%

Winakwa Community Centre Traffic and Parking Counts

West Access

2024-10-18	Time Start	NBL	NBR	WBL	EBR	TOTAL	HOUR
	18:00	0	0	0	0	0	8
	18:15	0	0	0	3	3	10
	18:30	0	0	1	1	2	10
	18:45	0	0	0	3	3	10
	19:00	1	0	0	1	2	10
	19:15	1	0	1	1	3	10
	19:30	0	0	0	2	2	15
	19:45	0	0	0	3	3	28
	20:00	0	0	0	2	2	34
	20:15	0	0	0	8	8	45
	20:30	1	0	3	11	15	44
	20:45	0	0	1	8	9	36
	21:00	0	0	2	11	13	30
	21:15	0	0	1	6	7	
	21:30	1	0	1	5	7	
	21:45	0	0	1	2	3	
	TOTAL	4	0	11	67	82	
	Peak Hr	1	0	7	36		

East Access

2024-10-18	Time Start	NBL	NBR	WBL	EBR	TOTAL	HOUR
	18:00	0	0	0	0	0	2
	18:15	0	0	0	0	0	2
	18:30	0	0	0	0	0	6
	18:45	0	1	1	0	2	6
	19:00	0	0	0	0	0	8
	19:15	1	1	2	0	4	8
	19:30	0	0	0	0	0	8
	19:45	2	1	1	0	4	12
	20:00	0	0	0	0	0	14
	20:15	4	0	0	0	4	22
	20:30	1	2	1	0	4	24
	20:45	6	0	0	0	6	24
	21:00	2	0	4	2	8	21
	21:15	3	0	1	2	6	
	21:30	3	0	1	0	4	
	21:45	0	0	3	0	3	
	TOTAL	22	5	14	4	45	
	Peak Hr	12	2	6	4		

Both Accesses

Both Accesses	HOUR
0	10
3	12
2	16
5	16
2	18
7	18
2	23
7	40
2	48
12	67
19	68
15	60
21	51
13	
11	
6	

Trips In	53
Trips Out	15
Total	68
ksf	20.7
Rate	3.29
% In	0.78

Parking	86	Spaces
2	2%	
5	6%	
7	8%	
10	12%	
10	12%	
11	13%	
13	15%	
14	16%	
16	19%	
20	23%	
31	36%	
33	38%	
50	58%	
59	69%	
62	72%	
68	79%	

Starting	2	Supply	86	
Veh In Lot		Utilization		Rate
2		2%		0.10
5		6%		0.24
7		8%		0.34
10		12%		0.48
10		12%		0.48
11		13%		0.53
13		15%		0.63
14		16%		0.68
16		19%		0.77
20		23%		0.97
31		36%		1.50
34		40%		1.64
51		59%		2.46
58		67%		2.80
61		71%		2.95
67		78%		3.24

West Access

2024-10-18	Time Start	NBL	NBR	WBL	EBR	TOTAL
	15:00					0
	15:15	0	0	0	8	8
	15:30	0	0	1	15	16
	15:45	0	0	0	16	16
	TOTAL	0	0	1	39	40

East Access

2024-10-18	Time Start	NBL	NBR	WBL	EBR	TOTAL
	15:00					0
	15:15	3	4	1	0	8
	15:30	10	5	4	1	20
	15:45	18	14	1	0	33
	TOTAL	31	23	6	1	61

Both Accesses

Both Accesses	HOUR
101	101

Trips In	47
Trips Out	54
Total	101
ksf	20.7
Rate	4.88
% In	0.47

Starting	0	Supply	86
Veh In Lot		Utilization	
0		0%	
2		2%	
8		9%	
-7		-8%	

Fermor Y Parking Data

Date	Time	Vehicles Counted	Available Supply	Utilization	Comments
Friday, April 5, 2024	11:00	73	137	53%	No soccer. Glenlawn school day.
Friday, April 5, 2024	18:00	121	205	59%	Soccer ongoing at artificial turf field
Saturday, April 6, 2024	11:00	161	205	79%	A few people at outdoor basketball and soccer field
Saturday, April 6, 2024	13:00	102	205	50%	Soccer match
Saturday, April 6, 2024	15:00	73	205	36%	No soccer

Parking Demand Projections

Phase 1

Weekday

	Profile		Rates		Demand			
			3.29	0.25	90	90	176	
Time	Rec Centre	Daycare	Rec Centre	Daycare	Rec Centre	Rec Assume	Daycare	TOTAL
6:00		0.11	0.00	0.03	0		5	5
7:00		0.45	0.00	0.11	0		19	19
8:00		0.89	0.00	0.22	0		39	39
9:00		0.93	0.00	0.23	0	44	40	84
10:00		1.00	0.00	0.25	0	44	44	88
11:00		1.00	0.00	0.25	0	44	44	88
12:00		0.97	0.00	0.24	0	44	42	86
13:00		0.93	0.00	0.23	0	44	40	84
14:00		0.88	0.00	0.22	0	44	39	83
15:00		0.82	0.00	0.21	0	44	37	81
16:00		0.88	0.00	0.22	0	44	39	83
17:00	0.15	0.96	0.49	0.24	44		42	86
18:00	0.15	0.61	0.48	0.15	43		26	69
19:00	0.20		0.65	0.00	59		0	59
20:00	0.48		1.59	0.00	143		0	143
21:00	1.00		3.29	0.00	296		0	296
22:00			0.00	0.00	0		0	0
23:00			0.00	0.00	0		0	0

Notes

- Rec Centre profile from Winakwa CC--outside count assume
- ITE profile similar to Transcona Kinsmen pool--pool not in Pha
- Daycare profile from ITE

Notes

- Rec Centre rate per Winakwa CC observations--assumed same rate for way bigger SWRC
- Daycare ITE average rate, based on # children

Saturday

	Profile		Rates		Demand			
			3.62	0	90	90	176	
Time	Rec Centre	Daycare	Rec Centre	Daycare	Rec Centre	Rec Assume	Daycare	TOTAL
6:00			0.00	0.00	0		0	0
7:00			0.00	0.00	0		0	0
8:00			0.00	0.00	0		0	0
9:00			0.00	0.00	0	235	0	235
10:00			0.00	0.00	0	235	0	235
11:00			0.00	0.00	0	235	0	235
12:00			0.00	0.00	0	235	0	235
13:00			0.00	0.00	0	235	0	235
14:00		1.00	0.00	0.00	0	235	0	235
15:00			0.00	0.00	0	235	0	235
16:00			0.00	0.00	0	235	0	235
17:00	0.72		2.61	0.00	235		0	235
18:00	1.00		3.62	0.00	326		0	326
19:00	0.99	0.70	3.57	0.00	321		0	321
20:00			0.00	0.00	0		0	0
21:00			0.00	0.00	0		0	0
22:00			0.00	0.00	0		0	0
23:00			0.00	0.00	0		0	0

Notes

- Rec Centre profile from Winakwa CC--times outside count a
- ITE profile similar to Transcona Kinsmen pool--pool not in Pha
- Daycare profile from ITE

Notes

- Rec Centre rate per Winakwa CC observations--assumed same rate for way bigger SWRC
- Daycare ITE average rate, based on # children

Phase 2

Weekday

	Profile				Rates				Demand						
					4.00	0.25	76.00	2.51	120	120	176	2	2	14.5	
Time	Rec Centre	Daycare	Ice Rink	Library	Rec Centre	Daycare	Ice Rink	Library	Rec Centre	Centre Assi	Daycare	Ice Rink	Rink - Assu	Library	TOTAL
6:00		0.11			0.00	0.03	0.00	0.00	0		5	0		0	5
7:00		0.45			0.00	0.11	0.00	0.00	0		19	0	114	0	133
8:00		0.89			0.00	0.22	0.00	0.00	0		39	0	114	0	153
9:00		0.93			0.00	0.23	0.00	0.00	0		40	0	114	0	154
10:00		1.00		0.78	0.00	0.25	0.00	1.96	0		44	0	114	28	186
11:00	0.95	1.00		0.87	3.80	0.25	0.00	2.18	456		44	0	114	32	646
12:00	0.83	0.97		0.80	3.32	0.24	0.00	2.01	398		42	0	114	29	583
13:00	0.65	0.93	0.60	1.00	2.60	0.23	45.60	2.51	312		40	91		36	479
14:00	0.56	0.88	0.48	0.86	2.24	0.22	36.48	2.16	269		39	73		31	412
15:00	0.64	0.82	0.56	0.93	2.56	0.21	42.56	2.33	307		37	85		34	463
16:00	0.75	0.88	0.90	0.79	3.00	0.22	68.40	1.98	360		39	137		29	565
17:00	0.84	0.96	0.99	0.82	3.36	0.24	75.24	2.06	403		42	150		30	625
18:00	1.00	0.61	1.00		4.00	0.15	76.00	0.00	480		26	152		0	658
19:00	0.99		0.95		3.96	0.00	72.20	0.00	475		0	144		0	619
20:00					0.00	0.00	0.00	0.00	0	191	0	0	114	0	305
21:00					0.00	0.00	0.00	0.00	0	395	0	0	114	0	509
22:00					0.00	0.00	0.00	0.00	0		0	0	76	0	76
23:00					0.00	0.00	0.00	0.00	0		0	0		0	0

Notes
- Profiles from ITE
- Library assumed open until 17:00

Notes
- ERRP at 4.00 per ksf per observations
- Daycare, Library & RMF ITE average rates
- Daycare based on # children

Saturday

	Profile				Rates				Demand						
					4.00	0	76	1.85	120	120	176	2	2	14.5	
Time	Rec Centre	Daycare	Ice Rink	Library	Rec Centre	Daycare	Ice Rink	Library	Rec Centre	Centre Assi	Daycare	Ice Rink	Rink - Assu	Library	TOTAL
6:00					0.00	0.00	0.00	0.00	0		0	0		0	0
7:00					0.00	0.00	0.00	0.00	0		0	0	114	0	114
8:00					0.00	0.00	0.00	0.00	0		0	0	114	0	114
9:00	1.00				4.00	0.00	0.00	0.00	480		0	0	114	0	594
10:00	0.89			0.78	3.56	0.00	0.00	1.44	427		0	0	114	21	562
11:00	0.80		0.72	0.87	3.20	0.00	54.72	1.61	384		0	109		23	516
12:00	0.68		0.81	0.80	2.72	0.00	61.56	1.48	326		0	123		21	470
13:00	0.60		0.91	1.00	2.40	0.00	69.16	1.85	288		0	138		27	453
14:00	0.60		1.00	0.86	2.40	0.00	76.00	1.59	288		0	152		23	463
15:00	0.53		0.98	0.93	2.12	0.00	74.48	1.72	254		0	149		25	428
16:00	0.52		0.91	0.79	2.08	0.00	69.16	1.46	250		0	138		21	409
17:00	0.49		0.77	0.82	1.96	0.00	58.52	1.52	235	200	0	117		22	574
18:00	0.50		0.83		2.00	0.00	63.08	0.00	240	188	0	126		0	554
19:00			0.77		0.00	0.00	58.52	0.00	0		0	117		0	117
20:00					0.00	0.00	0.00	0.00	0		0	0	114	0	114
21:00					0.00	0.00	0.00	0.00	0		0	0	114	0	114
22:00					0.00	0.00	0.00	0.00	0		0	0	76	0	76
23:00					0.00	0.00	0.00	0.00	0		0	0		0	0

Notes
- Profiles from ITE
- Library assumed open until 17:00

Notes
- Rec Centre rate per Winakwa CC observations--assumed same rate for way bigger SWRC
- Daycare ITE average rate, based on # children